2.0 Proposed Action and Alternatives

This chapter defines the GHPA boundaries, describes the existing and historic disturbances associated with uranium extraction present within the GHPA (Section 2.2, No Action Alternative), discusses the proposed development and activities that would occur during construction, operation, and decommissioning of the Project (Section 2.3, Proposed Action), and describes the alternatives analyzed in this document (Section 2.4, Resource Protection Alternative and Section 2.5, Alternatives Considered but Eliminated from Further Consideration). In developing the alternatives, the BLM followed guidance set forth in the BLM NEPA Handbook (H-1790-1), which provides for the development of a range of reasonable alternatives. Based on this guidance, the BLM developed the following alternatives for analysis in this EIS.

- **No Action Alternative:** This alternative assumes that approval of Cameco's Project is denied and certain existing infrastructure would be removed to release currently existing bonds. Exploration drilling would continue at a rate that would disturb less than 5 acres a year (Section 2.2, No Action Alternative).
- **Proposed Action Alternative:** This alternative consists of Cameco's proposal to develop 5 mine units and associated infrastructure within the GHPA to extract up to an estimated 2.5 million pounds of uranium oxide (U_3O_8) concentrate per year using ISR technology (Section 2.3, Proposed Action).
- **Resource Protection Alternative:** This alternative consists of Cameco's Project with the use of closed loop drilling systems and modifications to reduce the environmental impact of the project. Modifications include on-site processing of resin to produce slurry (Section 2.4, Resource Protection Alternative).

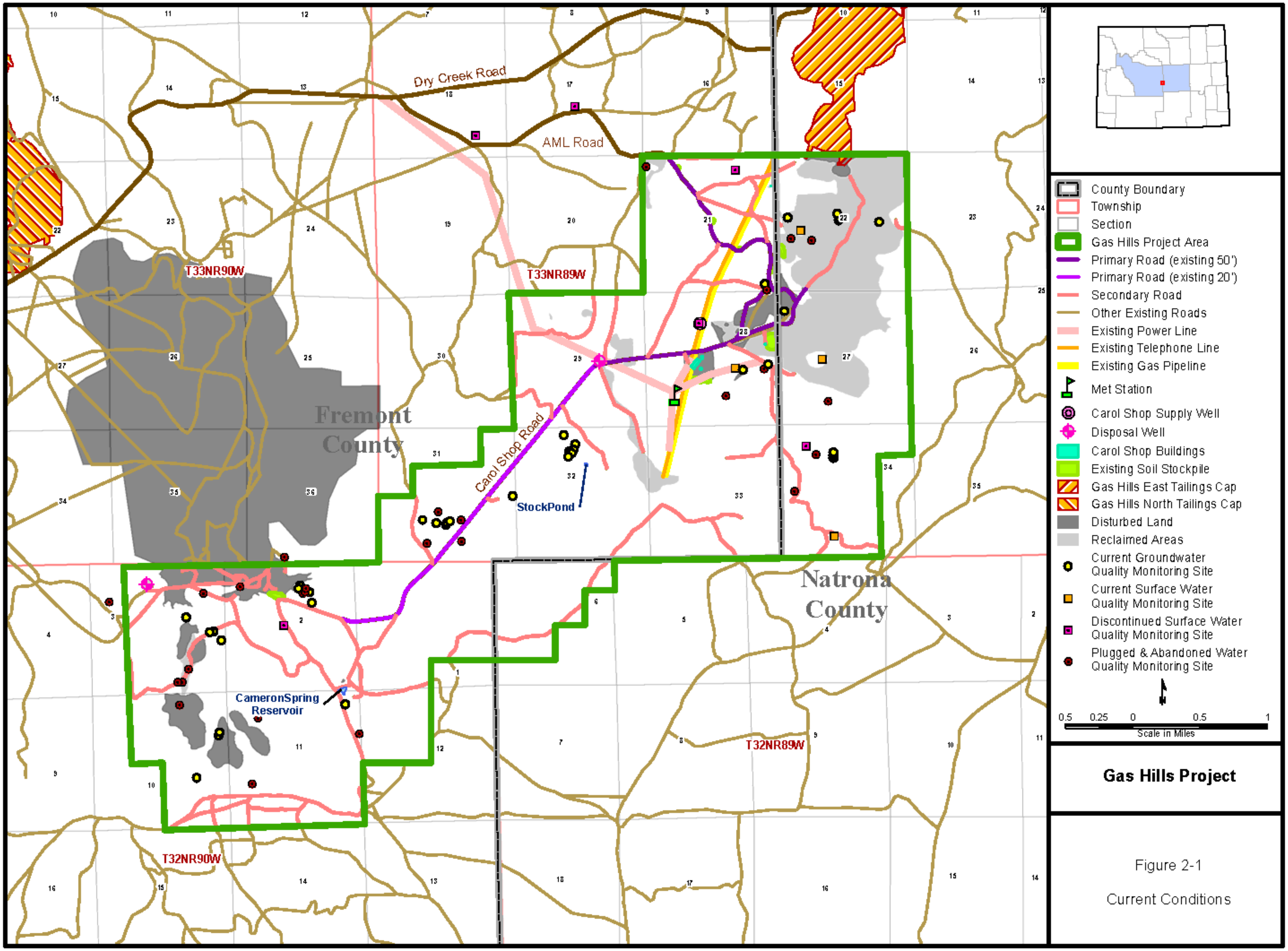
The No Action Alternative and each of the Action Alternatives are discussed in terms of alternative-specific activities, alternative-specific design features, and surface disturbance summaries. Alternatives considered but eliminated from detailed analysis are discussed in Section 2.5, Alternatives Considered but Eliminated from Further Consideration. The impact analysis of each alternative in Chapter 4.0, Environmental Consequences, focuses on the new disturbance that would occur under each alternative. Analysis of the cumulative impacts to the region in Chapter 5.0, Cumulative Impacts, describes the incremental impact of Project disturbance when added to other past, present, and reasonably foreseeable future actions in the area.

2.1 Existing Infrastructure and Disturbance in the Gas Hills Project Area

The GHPA is located in central Wyoming (**Figure 1-1**). The majority of the GHPA, Sections 21, 28, 29, 33, 32, and portions of Section 31 in T33N, R89W; and Sections 5 and 11 and portions of Sections 1, 3, 10, and 12 in T32N, R90W, is located in Fremont County under the jurisdiction of the BLM Lander FO. The remainder of the GHPA (Sections 22, 27, and portions of Section 34 within T33N, R89W) is within Natrona County and under the jurisdiction of the BLM Casper FO. Portions of Section 6 of T32N, R89W also are within Natrona County but are under the jurisdiction of the BLM Lander FO (**Figure 1-1**).

2.1.1 Existing Infrastructure

Within the GHPA, approximately 131 acres currently are disturbed by existing roads, utilities, or structures (**Figure 2-1**). The Project would use and maintain portions of this existing infrastructure to support mining activities.


Dry Creek Road
AML Road
Carol Shop Road
T33NR90W
T33NR89W
T32NR90W
T32NR89W
Fremont County
Natrona County
StockPond
CameronSpring Reservoir
County Boundary
Township
Section
Gas Hills Project Area
Primary Road (existing 50')
Primary Road (existing 20')
Secondary Road
Other Existing Roads
Existing Power Line
Existing Telephone Line
Existing Gas Pipeline
Met Station
Carol Shop Supply Well
Disposal Well
Carol Shop Buildings
Existing Soil Stockpile
Gas Hills East Tailings Cap
Gas Hills North Tailings Cap
Disturbed Land
Reclaimed Areas
Current Groundwater Quality Monitoring Site
Current Surface Water Quality Monitoring Site
Discontinued Surface Water Quality Monitoring Site
Plugged & Abandoned Water Quality Monitoring Site
0.5 0.25 0 0.5 1
Scale in Miles
Gas Hills Project
Figure 2-1
Current Conditions

Two main roads exist within the GHPA, the AML road (approximately 2.8 miles, or 17 acres) and the Carol Shop Road (approximately 5.8 miles, or 25 acres). The AML road provides access to the site at its origin where it intersects the Dry Creek Road which traverses the Gas Hills Region from its intersection with Wyoming State Highway 136 to its eastern terminus at the Natrona county line (**Figure 2-1**). In addition to the main roads within the GHPA, many smaller, predominantly 2-track roads currently exist. Many of these are roads historically used for exploration drilling and ongoing grazing activities. These roads currently disturb approximately 28.3 miles (68.6 acres) within the GHPA.

One existing structure and associated disturbance, the Carol Shop facility, occupies approximately 27 acres within NE¼ of the SW¼ (NESW Qtr/Qtr) of Section 28, T33N, R89W. This structure is a large, multiple-bay building that was used as a maintenance shop for past uranium mining activities.

Approximately 2.8 miles of overhead power lines that historically supplied power to the Carol Shop facility and other historic mine areas currently are located in Sections 28, 29, and 33, T33N, R89W.

Several piles of topsoil, originally developed for eventual reclamation of the Carol Shop facility and main roads, are distributed throughout the GHPA and occupy approximately 3.1 acres.

A meteorology monitoring station was completed in December 2010 within the SW¼ of T33N, R89W, Section 28, on approximately 0.1 acre. This monitoring station may be in use as long as the anticipated 25-year life of the Project. Two deep disposal test wells were drilled in 2011 on approximately 4 acres.

2.1.2 Existing Disturbance

Of the approximately 8,500 acres within the permit boundary, approximately 15 percent, or 1,300 acres, has previously been disturbed by mining activities, mining exploration and off-highway vehicle (OHV) use (**Figure 2-1**). Vegetation has re-established on the majority of these lands (approximately 900 acres); existing roadways, structures, and the Buss I Pit Lake in Section 27 of T33N, R89 remain disturbed (approximately 400 acres). The revegetated areas generally have a diverse species composition, although some lands in the northern portion of the GHPA are primarily a monoculture (crested wheatgrass). Sources of disturbance primarily are related to mining and associated infrastructure, as described in the following section.

2.1.2.1 Historic Mining

From the 1950s to the early 1980s, much of the surface area within and adjacent to the GHPA was extensively mined for uranium employing both underground and surface mining methods. The majority of the uranium ore was recovered by surface mining methods. Additionally, exploration drilling and associated access road construction completed since the 1950s has disturbed portions of the GHPA. Many of the historical drilling access roads still exist.

At least 12,000 exploration boreholes have been drilled by Cameco and previous mineral rights owners within the GHPA since the 1950s; these boreholes were constructed and abandoned according to rules and regulations in place at the time. This previous drilling has disturbed an estimated 260 acres within the 5 proposed mine units, or 27 percent of the approximately 977 acres within mine unit boundaries. Numerous historical open-pit or underground mining operations were located within and adjacent to the GHPA.

A portion of 1 historic uranium mining operation, the Gas Hills East (Umetco Minerals Corporation), is located on portions of Sections 22, 15, and 16, T33N, R89W, directly adjacent to the GHPA. This location includes a cap over historic uranium tailings, which is visible in **Figure 2-1**. Management of this capped area is currently being transferred to the Department of Energy, Office of Legacy Management (LM) under UMTRCA. Once transfer is complete the LM will implement a Long-term Surveillance Plan (LTSP), which will include inspection, monitoring, maintenance, and emergency measures designed to protect public health, safety, and the environment. For purposes of this EIS the BLM assumes that management of the capped area under the LTSP would not impact Cameco's ability to develop their mining claims.

The Lucky Mc (also called the Lucky Mac) mine operated between 1957 and 1988, as both an underground and open pit mine, and is currently owned by Pathfinder Mines Corporation. Portions of this mine is within the GHPA (Sections 25, 26, 27, 35, and 36 of T33N, R90W). Rehabilitation of the site began in 1991, and the ore processing facility was demolished in 1993. U.S. NRC determined that reclamation of mill tailings for the Lucky Mc (the Gas Hills North Tailings Cap) was complete in 2006. The site is not actively mined, and portions of the mine adjacent to the GHPA (in Sections 9, 10, 15, 21, and 22 of T33N, R90W) are currently being considered for transfer to LM under UMTRCA.

Exploration Drilling

Almost 1,000 of the existing boreholes and wells in the GHPA were drilled and installed by Cameco between 1996 and 2010. Boreholes were abandoned according to applicable rules and regulations. No drilling occurred during 2005-2006. Reclamation of recent exploration drilling activity takes place on an on-going basis and typically is completed within 1 year of the initial disturbance. In September 2008, Cameco plugged and abandoned 12 inoperable site monitoring wells.

2.2 No Action Alternative

Under the No Action Alternative, none of the proposed uranium mining or associated activities would occur within the GHPA. Currently, Cameco would be responsible for the removal and reclamation of the existing Carol Shop facility and a portion of the AML road running from the GHPA boundary in the NW¼ of Section 21, T33N, R89W to the Carol Shop (**Figure 2-2**). Reclamation would be required to meet performance obligations, currently secured by bonds, and would include the redistribution of topsoil currently stockpiled within the GHPA (**Figure 2-2**). Under this Alternative, the Carol Shop facility would be removed and approximately 26.7 acres of disturbance would be reclaimed. If no other need for the AML road were determined, 1.8 miles also would be removed and approximately 10.9 acres (based on the current 50-foot disturbance for the road) would be reclaimed. Topsoil stored on approximately 2.6 acres would be redistributed on reclaimed areas. Existing notice-level activity within the GHPA also would be reclaimed. Under this alternative, a total of approximately 40.2 acres (less than 1 percent) within the GHPA would be reclaimed.

New disturbance associated with continued exploration activities could continue within the GHPA for any NOI accepted by the BLM for activities authorized under the 43 CFR 3809 surface management regulations. Exploration-related activities on BLM-managed lands may not result in over 5 acres of unreclaimed surface disturbance at any time during the life of the Notice of Intent filed for each action. Reclamation of these sites would be anticipated to occur within the same calendar year as the disturbance.

Analysis of the No Action Alternative is required under NEPA (43 CFR Section 1502.14[d]). The No Action Alternative may be selected by the BLM if the agency disapproves Cameco's PoO because the Project would cause undue or unnecessary degradation to resources managed by the agency (43 CFR, Section 3809.411[d][3][iii]).

2.3 Proposed Action

Cameco proposes the development of uranium deposits in the GHPA through implementation of the ISR process, which involves recovery of uranium from the subsurface through chemical dissolution using wells constructed similarly to conventional water wells (Proposed Action). The process requires installation of surface infrastructure (processing facilities, waste water disposal facilities, roads, header

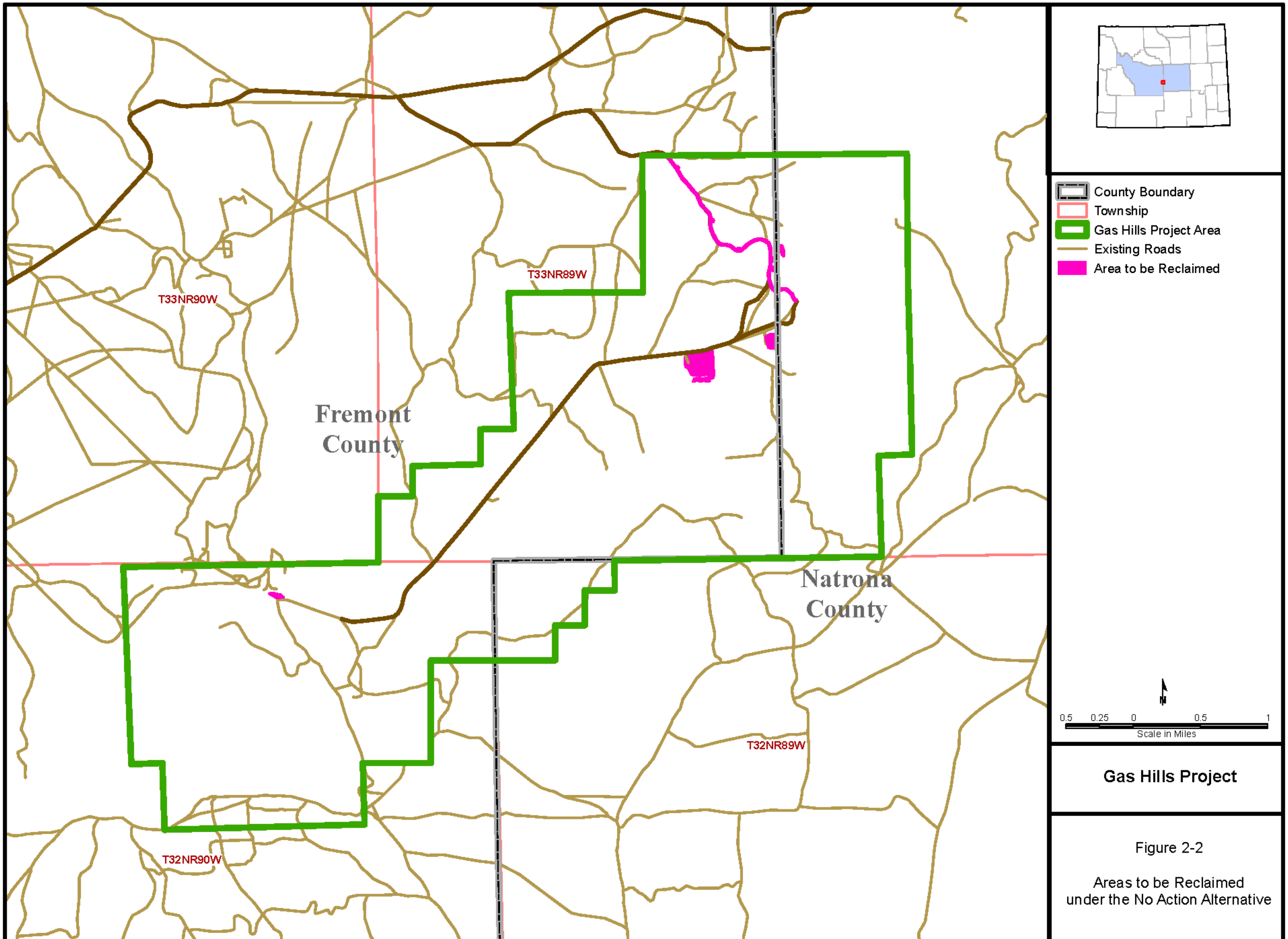


Figure 2-2

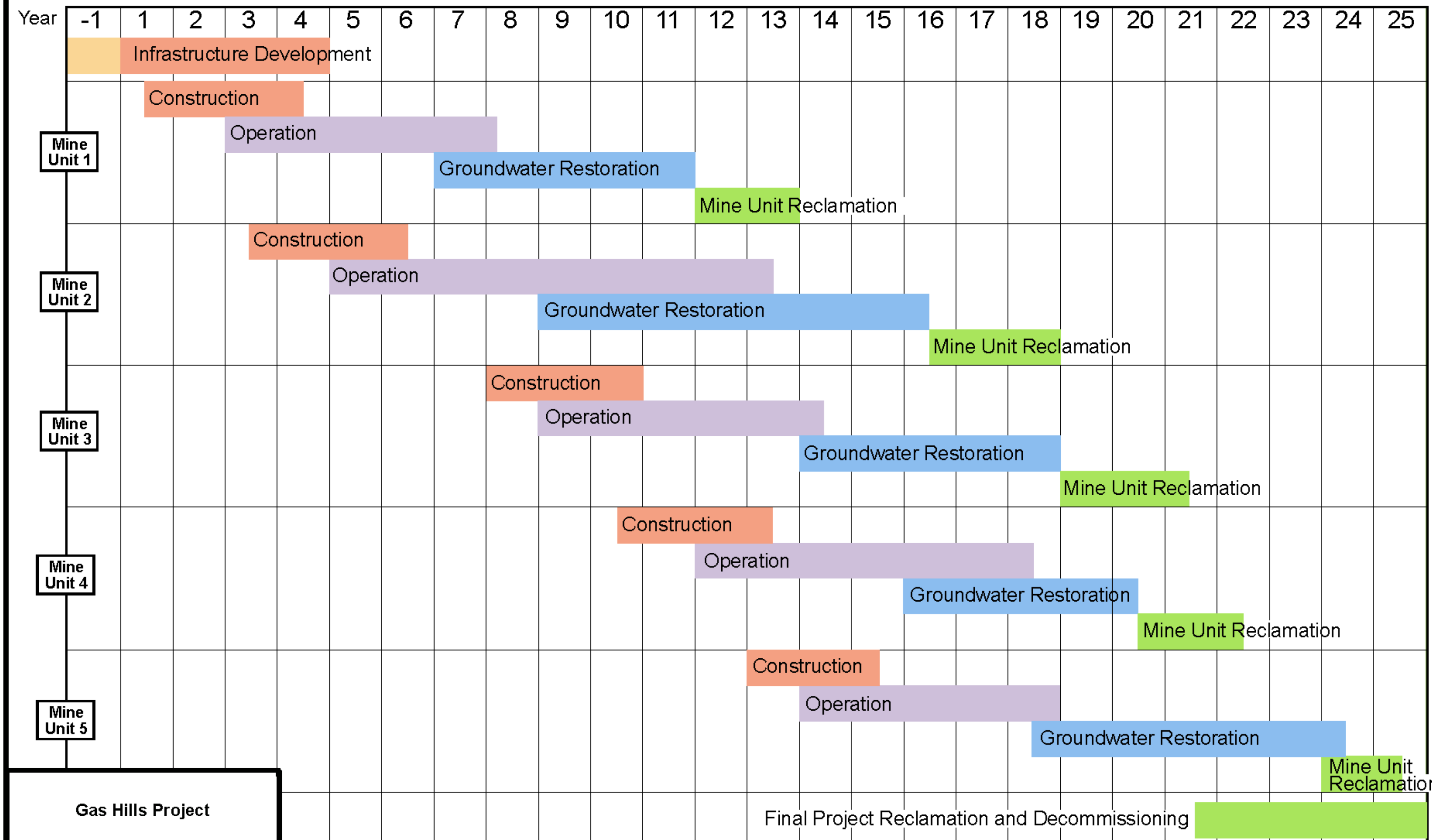
Areas to be Reclaimed under the No Action Alternative houses, and power lines) as well as subsurface infrastructure (wells, pipelines, electrical lines, and communication cables). Activities associated with the Proposed Action would occur throughout the projected 25-year span of the Project, and would include the following phases:

1. **Infrastructure Development** – Construction or improvement activities occurring within the GHPA, but outside of mine units, including: upgrades to project infrastructure within the GHPA (roads, electrical lines, water disposal, and pipelines); and construction or upgrades to processing facilities (Section 2.3.1, Infrastructure Development)
2. **Mine Unit Construction** – Construction activities occurring within mine units, including: delineation drilling; installation of injection, production and monitoring wells, pipelines, booster pump stations, header houses, and roads to header houses (Section 2.3.2, Mine Unit Construction).
3. **Mine Unit Operation** – Operation of the ISR process to remove and process uranium; interim reclamation of the majority of the mine unit construction disturbance (Section 2.3.3, Mine Unit Operation).
4. **Mine Unit Restoration and Reclamation** – Restoration of groundwater; and decommissioning and removal of mine unit infrastructure and final surface reclamation within each mine unit (Section 2.3.4, Personnel/Work Force).
5. **Final Project Reclamation and Decommissioning** – Decommissioning and reclamation of surface and subsurface infrastructure within the GHPA but outside of the mine units, such as evaporation ponds, roads and satellite facilities (Section 2.3.5, Mine Unit Restoration and Reclamation).

Descriptions of the various aspects of the Project are derived in part from the Revised PoO (PRI 2011a) and Cameco's WDEQ mine permit update – Permit 687 (PRI 2009). General descriptions of ISR project components were derived from the U.S. NRC's Generic EIS for ISR facilities (U.S. NRC 2009) in addition to the information in the WDEQ mine permit update. These activities may occur simultaneously while different mine units are constructed, operated, and reclaimed during the span of the Gas Hills Project (**Figure 2-3**).

For the purpose of analysis, it is assumed that the surface within a mine unit would be completely disturbed during construction activities, although it is possible that small patches of vegetation may be left intact. See **Appendix A**, **Figure A1** for a typical mine unit pattern. Surface disturbance within a mine unit would be phased over several years at a rate that would depend on the uranium production rate and the availability of mine construction equipment and personnel. During operations, approximately 95 percent of the mine unit would undergo interim reclamation, and the remaining 5 percent would remain disturbed during operations for roads, header houses, well heads, and power lines. Access to well heads during mine unit operation would cause compaction and disturbance on an estimated 45 percent of the mine unit, for a total disturbance of 50 percent. The mine unit surface would again be completely disturbed during mine unit decommissioning, after which the mine unit would undergo final reclamation. Final reclamation would include plugging and abandoning all wells, removing header houses and buried piping, and re-grading and seeding the disturbed surface.

The surface disturbance associated with facilities within the GHPA but outside of mine unit boundaries, such as evaporation ponds, wastewater deep disposal wells or mineral processing and water treatment facilities, would remain for the projected 25-year life of the Project. At the end of the Project, all of these facilities would be decommissioned or removed and disturbed areas would be reclaimed to the pre-mining land use. Disturbances associated with the Proposed Action are summarized in **Table 2-1**.



Gas Hills Project

Figure 2-3

Project Activity Schedule

Source: PRI 2009, Figure OP1-3.

Table 2-1 Proposed Action Disturbance Summary

Mine Component	Disturbance (acres)	
	Construction/ Decommissioning (+15 percent)[a]	Operation (+15 percent)[a]
Mine Unit Disturbance, Including Monitoring Well Ring		
Mine Unit 1[b]	156 (179)	78 (90)
Monitoring well ring for Mine Unit 1[c]	11 (13)	6 (7)
Mine Unit 2[b]	365 (420)	183 (210)
Monitoring well ring for Mine Unit 2[c]	10 (12)	6 (7)
Mine Unit 3[b]	90 (103)	45 (52)
Monitoring well ring for Mine Unit 3[c]	10 (12)	6 (7)
Mine Unit 4[b]	255 (293)	128 (147)
Monitoring well ring for Mine Unit 4[c]	9 (10)	5 (6)
Mine Unit 5[b]	111 (127)	56 (64)
Monitoring well ring for Mine Unit 5[c]	8 (9)	4 (5)
Subtotal for Mine Unit Disturbance	**1,025 (1,178)**	**517 (595)**
Project Infrastructure Outside of Mine Units		
Roads/Utility Corridors[d]	209	38
Surface Facilities		
Carol Shop Facility[e]	0	0
Satellite Facility[f]	10	10
Evaporation Ponds and Diversions	62	62
Disposal Wells[g]	6	3
Topsoil Stockpiles	3	3
Subtotal for Disturbance Outside of Mine Units	**290**	**116**
Grand Total	**1,315 (1,468)**	**633 (711)**

[a] Mine Unit area may expand based on results of delineation drilling; to account for this possible expansion, disturbance estimates for mine units and their associated monitoring well rings are conservatively increased by 15 percent.

[b] Disturbance of the entire Mine Unit is anticipated during construction and decommissioning. Operational disturbance for facilities (primary and secondary roads, header houses, valve boxes, and well heads) is conservatively estimated to be 5 percent of the Mine Unit area. The remaining 95 percent of the Mine Unit would undergo interim reclamation for the duration of operations; however, an estimated 45 percent of the Mine Unit would be impacted by cross-country mechanized travel to well heads, for a total of 50 percent disturbance of a Mine Unit during operation.

[c] Construction disturbance for monitoring well rings is based on a disturbance width of 18 feet. Operational disturbance for monitoring well rings is based on a disturbance width of 10 feet.

[d] Road/utility corridor construction disturbance for new, existing, and upgraded existing roads is based on a width of 60 feet for primary roads, 40 feet for secondary roads, 50 feet for underground utilities, and 30 feet for overhead power lines. Road/utility corridor operational disturbance based on a width of 30 feet for primary roads and 15 feet for secondary roads; utility corridors would undergo interim reclamation during operations. Includes disturbance for approximately 1.4 miles (8.3 acres, based on a 50-foot wide disturbance) for a process water pipeline that would not be adjacent to a proposed road.

[e] The Carol Shop facility is located on 27 acres of existing disturbance and would not involve new disturbance under the Proposed Action.

[f] Conservatively includes the disturbance for both proposed satellite facility locations although only 1 would be constructed. Disturbance for each location (approximately 5 acres) includes the building plus additional area for parking and access.

[g] Based on disturbance of 2 acres for construction and 1 acre for operation of each of 3 proposed disposal well locations. Two deep disposal test wells were drilled in 2011; further development will require re-disturbance.

2.3.1 Infrastructure Development

2.3.1.1 Satellite Facilities

The proposed satellite facilities would be centrally located buildings containing equipment for preparing ISR solutions, as well as the ion-exchange equipment for stripping uranium and other materials from water used in the ISR process. Cameco proposes to use the existing Carol Shop facility for the first satellite facility to be developed for the Project. The existing building would be upgraded to house the central water treatment facility, ion-exchange columns, associated equipment and piping, offices, and maintenance facilities. One additional satellite facility would be constructed to house additional ion-exchange, resin loading and unloading, and future reverse osmosis (RO) capacity located at either of 2 possible satellite locations, as shown in **Figure 2-4**. While Cameco may decide not to build the additional satellite facility, the BLM has assumed Cameco would construct 1 additional facility at 1 of the 2 possible locations, both of which are analyzed in this EIS.

2.3.1.2 Waste Management

<u>Wastewater Disposal Facilities</u>

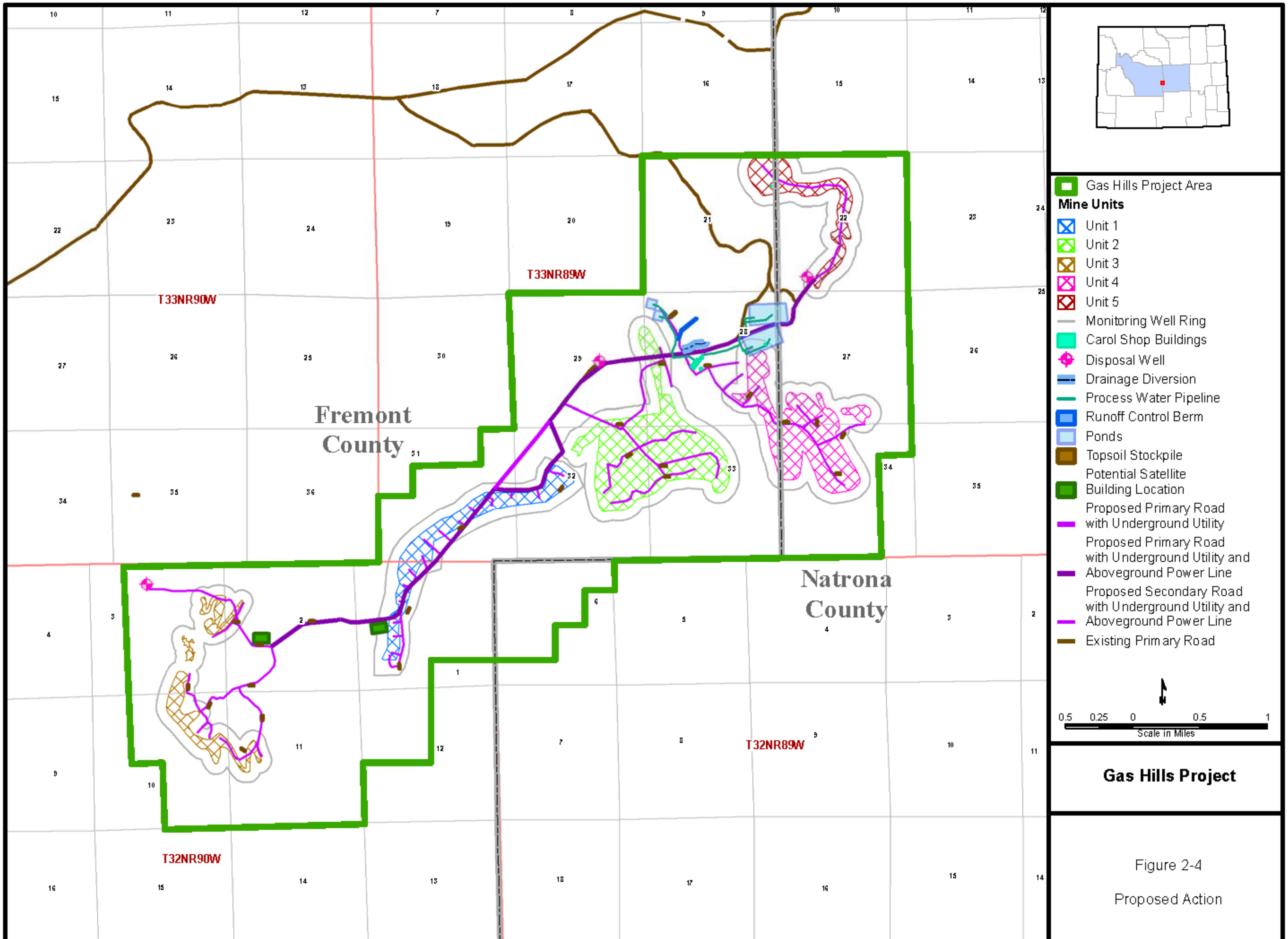
Water from which uranium has been removed using ion-exchange equipment may be re-used in the ISR mining process or be disposed of during mine operation. Liquid waste produced during operations primarily would be from process wastewater streams consisting of well-field bleed, RO brine fluids, and satellite washdown water.

Cameco proposes 2 water disposal methods for use in the Proposed Action. The first method would be disposal into solar evaporation ponds that would be designed and constructed to contain the water volume to be disposed of during Project operation. Evaporation ponds would be lined, the perimeter would be bermed to prevent run-on of surface drainage and fenced to exclude wildlife and livestock, and the ponds would be located similarly to those shown in **Figure 2-4**. Topsoil excavated from the ponds would be segregated and stockpiled in long-term topsoil stockpiles. Evaporation ponds would be fenced following BLM Handbook H 1741-1 standards to prevent both livestock and large game animals from accessing the ponds. Although waterfowl are not anticipated to use the evaporation ponds, Cameco will monitor the ponds for waterfowl activity and implement measures to remove, exclude, or deter them if necessary.

The evaporation ponds would be designed to operate in pairs as below-grade impoundments during regular operation, where the excavated materials would be piled above-grade for additional storage capacity, surface water isolation, and freeboard requirements. See **Appendix A**, **Figure A-2** for more specific pond design. Ponds would be operated essentially at one-half capacity to allow for the evacuation of one pond's contents into its partner in the event that a pond requires servicing.

Each evaporation pond would be lined with a 60 millimeter high density polyethylene liner (or equivalent). Leak detection would be installed under the liner, consisting of a secondary compacted clay liner (maximum permeability of 10^{-7} centimeters per second) or 30 mil polyvinyl chloride liner (or equivalent). Leak detection piping would be situated between the two liners in granular backfill with gravity flow to an inspection manhole.

The evaporation ponds, berms, surface water diversions, storm water control measures, and leak detection inspection manhole would be visually inspected daily. The manhole sump pump would be tested at least once every two weeks. In the event the sump pump is observed operating, a water sample would be collected and analyzed for chloride, bicarbonate, and conductivity. If the analysis indicated the ponds to be leaking, the contents of the leaking pond would be transferred into another pond, the U.S. NRC and WDEQ-LQD would be notified within 48 hours and a written report would be submitted within 60 days. An investigation would be conducted to determine the source of the leak, and once identified, the leak and any damage to the system would be repaired. Additional testing and



Gas Hills Project

Figure 2-4

Proposed Action

sampling would continue when pond operation resumed, and a final written report would be submitted describing all remedial and repair activities within 60 days after repairs have been completed (PRI 2009).

To augment the solar evaporation pond capacity over time, forced evaporation and crystallization equipment would be added within the Carol Shop facility at the beginning of operational Year 6. The distillation and crystallization process would heat the wastewater feed to the boiling point; the steam would be allowed to cool resulting in a condensate of distilled water. The distilled water would be consumed in the plant, used as a source of restoration water, used for mine unit hydrologic control, or stored in ponds. Waste brine generated by the evaporator would be transferred to the crystallizer where it would be heated to drive off residual moisture and reduced to a dry solid that can be removed and stored for disposal at a permitted disposal facility (PRI 2011a).

The second wastewater disposal method would be to use 1 or more Class I injection wells (wells that inject industrial or municipal non-hazardous wastes below the deepest underground source of drinking water) for deep injection of wastewater. Cameco is evaluating whether deep disposal wells are technically feasible by drilling to the target geological formation, and testing the formation's ability to receive the desired volume of water. Two deep disposal test weels were drilled in 2011, and testing is anticipated during 2012. Current target formations include the Cloverly, Morrison, Nugget, Phosphoria, Tensleep, Madison, and Flathead formations which range in depth from 800 to over 4,000 feet. If a deep disposal well for wastewater is technically feasible, Cameco would apply for a permit from WDEQ-WQD (with concurrence from USEPA) to employ deep wastewater injection as the primary means of water disposal. Use of deep disposal wells for wastewater would reduce the volume of solid material in evaporation ponds that would eventually require disposal at off-site permitted facilities as discussed in Section 2.3.3.1, In-situ Recovery.

Three candidate test well locations for deep disposal wells have been identified (**Figure 2-3**). If testing of the first well indicates that it would be suitable for injection of wastewater, Cameco would permit the well for disposal, and would drill up to 2 additional disposal wells at the alternate locations. For purposes of analysis in this EIS, the BLM has assumed that both water disposal methods would be developed for the Project.

Hazardous Materials

Any hazardous or toxic materials used for uranium processing would be handled, stored, and/or disposed of in accordance with state and federal hazardous materials requirements and pursuant to standard operating procedures.

Storm Water

Construction disturbances and associated potential for the discharge of pollutants in the form of surface materials and sediment into Waters of the State (defined as all surface and groundwater, including waters associated with wetlands, within Wyoming) via storm water runoff would be controlled using Best Management Practices (BMPs) as described in Cameco's Gas Hills Project Storm Water Pollution Prevention Plan (SWPPP). The SWPPP was prepared as part of the Gas Hills WDEQ-WQD General Permit No. WYR103870 to discharge storm water associated with large construction activity under the Wyoming Pollutant Discharge Elimination System. The SWPPP would be modified with any change in design, construction, operation or maintenance that may change the potential for the discharge of pollutants into Waters of the State. A copy of the SWPPP currently is maintained at the Gas Hills site. When operations commence at the GHPA, this construction permit would be converted to an industrial activity permit.

Sewage

Domestic sewage also would be produced and would be handled by conventional septic/leach field systems. In addition to the existing system at the Carol Shop facility, other systems would be constructed at alternate satellite locations. These systems would be intended to receive non-contaminated wastes from restrooms, shower facilities, and miscellaneous sinks located within the Project facilities. A new well would be drilled to provide domestic water for the showers and other sanitary facilities at the Carol Shop facility. Temporary chemical toilets would be used in well-field and drilling areas when use of the satellite facilities is time consuming or inconvenient.

Solid Wastes

During operations, non-contaminated wastes as defined by the AEA would include office and food wastes, paper and wood products, and steel. These wastes temporarily would be stored on-site and periodically transported to a municipal landfill by a contract waste disposal operator.

Radiologically contaminated wastes would be generated during the uranium recovery operations. These wastes would include process pipe and equipment, tanks and vessels, ion-exchange resin, filter media, and the solid residue and liners from the evaporation ponds. An estimated maximum of 300 cubic yards of contaminated waste could be generated per year by the Project. Cameco currently has a contract disposal agreement with Denison Mines to dispose of these Gas Hills byproduct wastes at their Blanding, Utah facility.

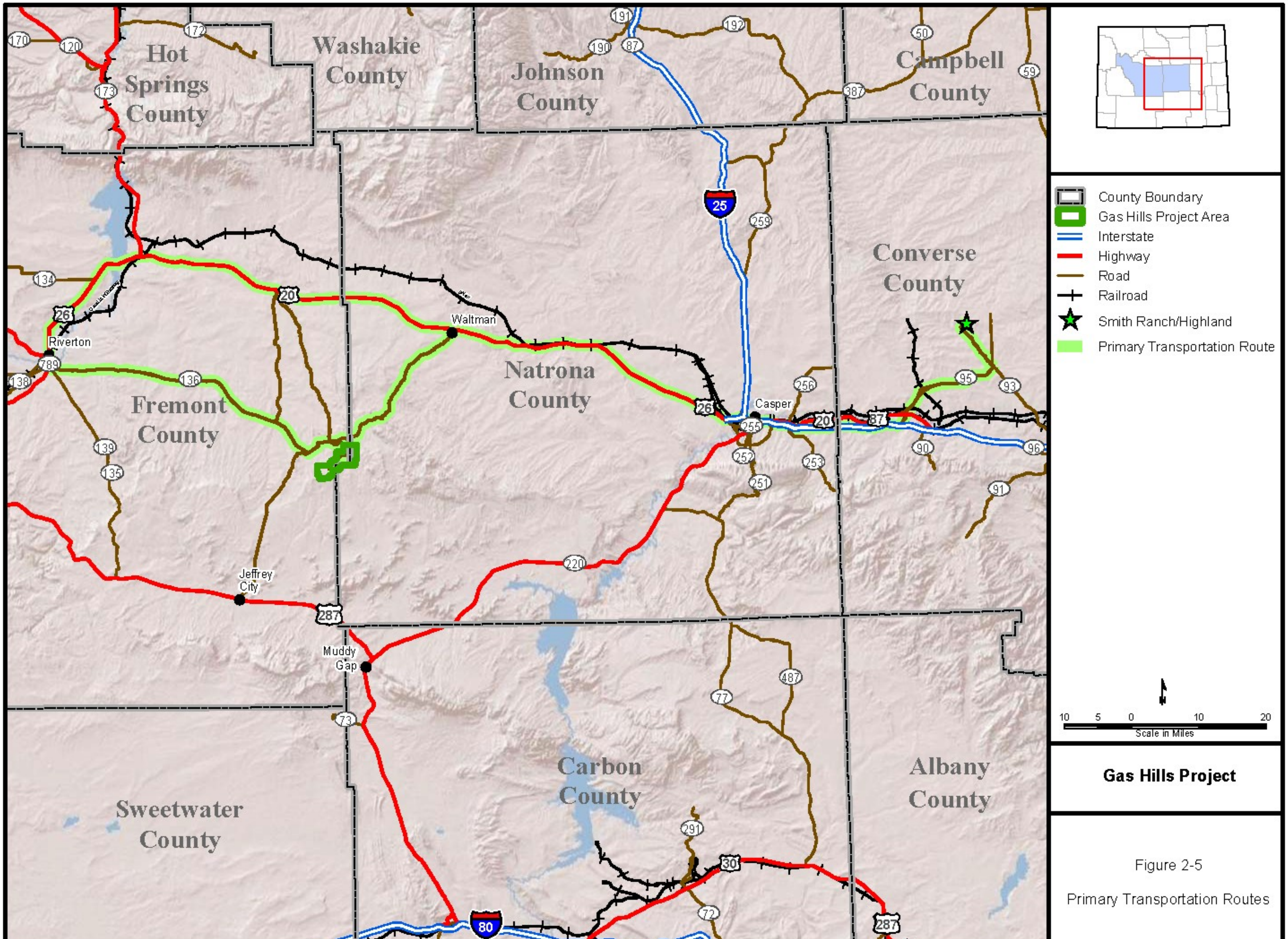
2.3.1.3 Access Roads

Existing major roadways would provide access to the GHPA, and new or upgraded existing roads would provide access within the GHPA between the 5 mine units. Three types of roads would be used during Project construction and operation: primary and secondary roads would be constructed, graveled, and maintained for the use of the Project and would be designed for designated speed limits; and 2-track roads would be developed for light use, primarily as access to perimeter monitoring wells surrounding mine units. The BLM would require that all roads for the Project be built to BLM standards (The Gold Book, USDOI and USDA 2007), which include road grade less than 8 percent, except for pitch grades of less than 300 feet.

The Carol Shop Road would be the primary road within the GHPA, with a speed limit of 40 miles per hour (mph). Year-round access to and from the GHPA would be over existing State Highway 136 (also known as the Gas Hills Road) from Riverton, Wyoming, to the Dry Creek Road, connecting with the Carol Shop Road (**Figure 2-5**) via the AML road. Alternate access to the GHPA would be via Fremont County Road No. 5 (also known as the Ore Road or Haul Road) from Jeffrey City to the Dry Creek Road, or via Natrona County Road No. 212 (also known as the Gas Hills Road or Waltman Road) from Waltman to the Carol Shop Road. All vehicles travelling on public roads would comply with the Wyoming Highway Department’s Rules and Regulations. As each mine unit is delineated, designed and developed, secondary access roads would be required to provide access to each of the header houses within the mine units.

Access to well heads and monitoring wells within mine units would be cross-country; no grading for this access would occur except in areas where the slope exceeds 25 percent.

Roads would be constructed as shown in **Appendix A, Figure A-3** for typical road construction details. Primary and secondary access roads would use culvert crossings at significant drainages (see **Appendix A, Figure A-4** for a typical culvert installation). Primary access roads would be 30 feet wide with a 60-foot right-of-way (ROW), and secondary access roads would be 15 feet wide with a 40-foot ROW. Most traffic at the Project site would be limited to pick-up trucks and typical over-the-road drill rigs, flatbed trucks, and other similar vehicles. Reduced speed limits would be posted and maintained on access roads for employee safety and to minimize the potential for collision with wildlife.



Gas Hills Project

Figure 2-5

Primary Transportation Routes

2.3.1.4 Pipelines

Underground pipelines would be installed between the satellite and water disposal facilities (both evaporation ponds and disposal wells). Pipelines also would be installed between the satellite facilities and the header houses at the mine units within existing or proposed road ROWs.

If large, inflexible, or multiple pipelines are placed in a trench, Cameco would construct the pipeline trench with an excavator or backhoe and would stockpile, and then immediately replace the topsoil. In some cases, and where small flexible pipe is installed, Cameco would use a trenching machine or spider plow. These types of machines do not require topsoil segregation and reduce the overall disturbance footprint and intensity.

2.3.1.5 Power Lines

Aboveground power lines would be constructed within proposed or existing road ROWs from the existing power lines terminating near the Carol Shop facility to each of the header houses within the mine units. New power lines would be constructed to minimize potential electrocution hazards to raptors by following the guidance in "Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 2006," by the Avian Power Line Interaction Committee (APLIC) (2006).

2.3.1.6 Water Use

All water used for the Project would be obtained from groundwater within the GHPA appropriated in accordance with state requirements. Surface and groundwater rights appropriations in the area historically have been used for livestock watering, by wildlife, and for limited non-industrial domestic purposes associated with past mining operations. No public water supply wells or intakes are located within the GHPA.

Table 2-2 lists the estimated water volumes to be used by the Project over the life of the planned operations. It is estimated that the maximum annual volume of groundwater that would require disposal over the life of the Project would be 420 acre-feet. This water would be disposed of using methods described in Section 2.3.1.2, Waste Management, of this document.

Table 2-2 Projected Water Disposal

Year of Operation[a]	Water Flow (acre-feet/year)[b]	Water Consumed (acre/ft/year)[c]
1	4,516	9
2	9,033	18
3	11,452	23
4	13,711	27
5	15,324	205
6	15,969	350
7	18,550	418
8	19,195	420
9	18,388	418
10	17,420	416
11	16,614	415
12	16,130	414

Table 2-2 Projected Water Disposal

Year of Operation[a]	Water Flow (acre-feet/year)[b]	Water Consumed (acre/ft/year)[c]
13	15,646	413
14	12,517	407
15	10,014	402
16	7,010	396
17	4,907	391
18	3,434	389
19	2,405	387
20	1,682	64

[a] Year of operation is based on the first full year of ISR mining and does not include the period for construction of Mine Unit 1 or for construction of Project infrastructure.

[b] One acre-foot is equivalent to approximately 325,851 gallons.

[c] Volume of water per year circulated through the Project infrastructure and the subsurface ore zone to extract uranium from the subsurface and to accomplish groundwater restoration. Most of this water would be recycled through the system multiple times.

[d] Volume of water per year that would be disposed of each year of system operation. This volume would constitute consumptive use by the Project.

Source: Table OP3-3, Operations Plan (PRI 2009).

2.3.2 Mine Unit Construction

Construction of each mine unit would involve disturbance of the entire mine unit ground surface for the following activities, each of which are described in greater detail later in the section:

- Delineation drilling to refine ore body limits;
- Hydrologic testing;
- Installation of injection, production, and monitoring wells;
- Construction of primary and secondary access roads within mine units, and installation of underground utilities (piping, power lines, communication cables); and
- Construction of header houses.

Surface disturbance within each mine unit would not occur all at once but would be sequenced over several years, depending on the uranium production rate and on the availability of mine unit development and construction equipment and personnel. Cameco anticipates it would take 2 to 3 years to complete the construction of a mine unit, including injection/production wells, pipeline/electrical power corridors, header houses, and access roads associated with a given mine unit. Each mine unit would be constructed sequentially, and Cameco would not have more than 2 mine units in production at any one time. Additionally, Cameco would not begin production in Mine Unit 4 until groundwater restoration (as described later in this document in 2.3.5.1, Groundwater Restoration) was completed. **Appendix A, Figure A-1** illustrates a typical mine unit pattern installation consisting of injection wells, production wells, monitoring wells, pipelines, access roads, power lines, and a header house.

In addition to truck-mounted rotary drill rigs and water trucks, other equipment employed during mine unit construction would include truck mounted pump pulling units, truck-mounted hose reels, electrical generators, backhoes, and light duty 4-wheel drive vehicles. **Figures 2-6** and **2-7** show typical arrangement of the vehicles during the 3 to 5 days it generally takes to drill each well. Mine unit construction also would require the use of temporary cement batch plants within mine units to support well and header house installation. Additional ancillary construction material would be contained within the Carol Shop facility or mine unit disturbance areas.

2.3.2.1 Delineation Drilling

The shape, distribution, and grade of the uranium deposits determine the location and shape of mine units, as well as the final injection or production well placement, well density, and the resulting supporting facilities (e.g., roads and pipelines). To determine the extent of the deposits, multiple test holes would be drilled in a process called delineation drilling, which would determine the final location of ISR wells. The surface disturbance footprint for all delineation boreholes would be within each mine unit (see assumptions in **Table 2-1**). Delineation drilling would occur throughout each year, depending on production and development needs. Typically, 200 to 500 delineation drill holes would be completed each year.

Delineation holes would be constructed using truck mounted rotary drill rigs and water trucks (**Figures 2-6** and **2-7**). Materials removed from the boreholes during drilling (drilling mud) would be collected in temporary pits (drilling mud pits). The drilling mud pits would be fenced until the contained fluid has been removed or has evaporated and the pits have been reclaimed. Topsoil from drill holes and drilling mud pits would be salvaged and placed in short-term stockpiles.

An average of 14 drill rigs are anticipated to operate on-site simultaneously for delineation drilling. Once information from each borehole is gathered and logged, it would be plugged and abandoned.

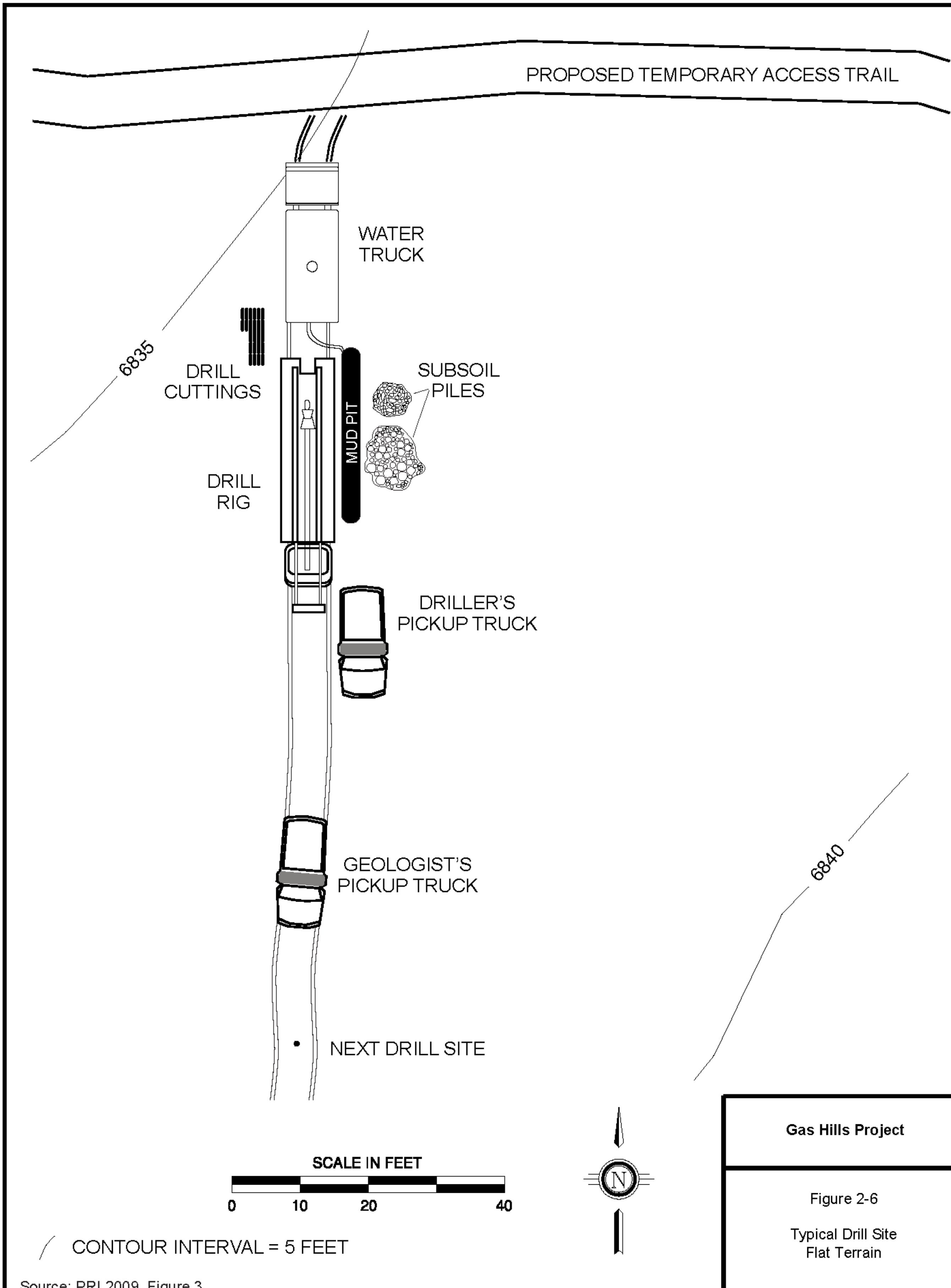
The drilling mud pit would be allowed to dry out for several days prior to backfilling. Prior to drill hole abandonment, techniques such as siphoning the water from the pit back into the drill hole or removing excess water from the pit for use at other drill sites may be used to expedite drilling mud pit reclamation. After backfilling the drilling mud pits with subsoil, the pits would be allowed to settle before applying the topsoil and performing final grading. Compaction may be used to further reduce potential settling of reclaimed drilling mud pits. Steep slope sites and access routes would be reclaimed using a dozer, track hoe, or similar equipment to minimize the surface disturbance.

Drill sites that would become part of a mine unit within 1 year of drilling would not be seeded until mine unit construction is complete. Those sites that would not become part of a mine unit within 1 year would be seeded after drilling mud pit reclamation is complete. In either case, seed would be planted during the next available seeding window, spring or fall.

2.3.2.2 Hydrologic Testing

Following completion of delineation drilling, detailed hydrologic testing would be conducted for each mine unit based on site-specific test plans. The purpose of the tests would be to collect and assemble detailed geologic and hydrologic information to define injection pattern areas, quantify hydrologic parameters (e.g., hydraulic conductivity, porosity, hydraulic communication patterns), develop hydrologic monitoring plans, and define baseline groundwater quality.

As part of the hydrologic testing, monitoring wells would be installed within and around the mine unit (**Figure 2-4**). Once monitoring wells were installed, aquifer testing would be conducted. Results of the testing would be submitted to WDEQ-LQD prior to mine unit development. Monitoring wells also would be installed within the mine unit and used to monitor the mine unit throughout operation and restoration of the unit (see **Appendix A, Figure A-1** for a typical mine unit pattern installation). The combination of

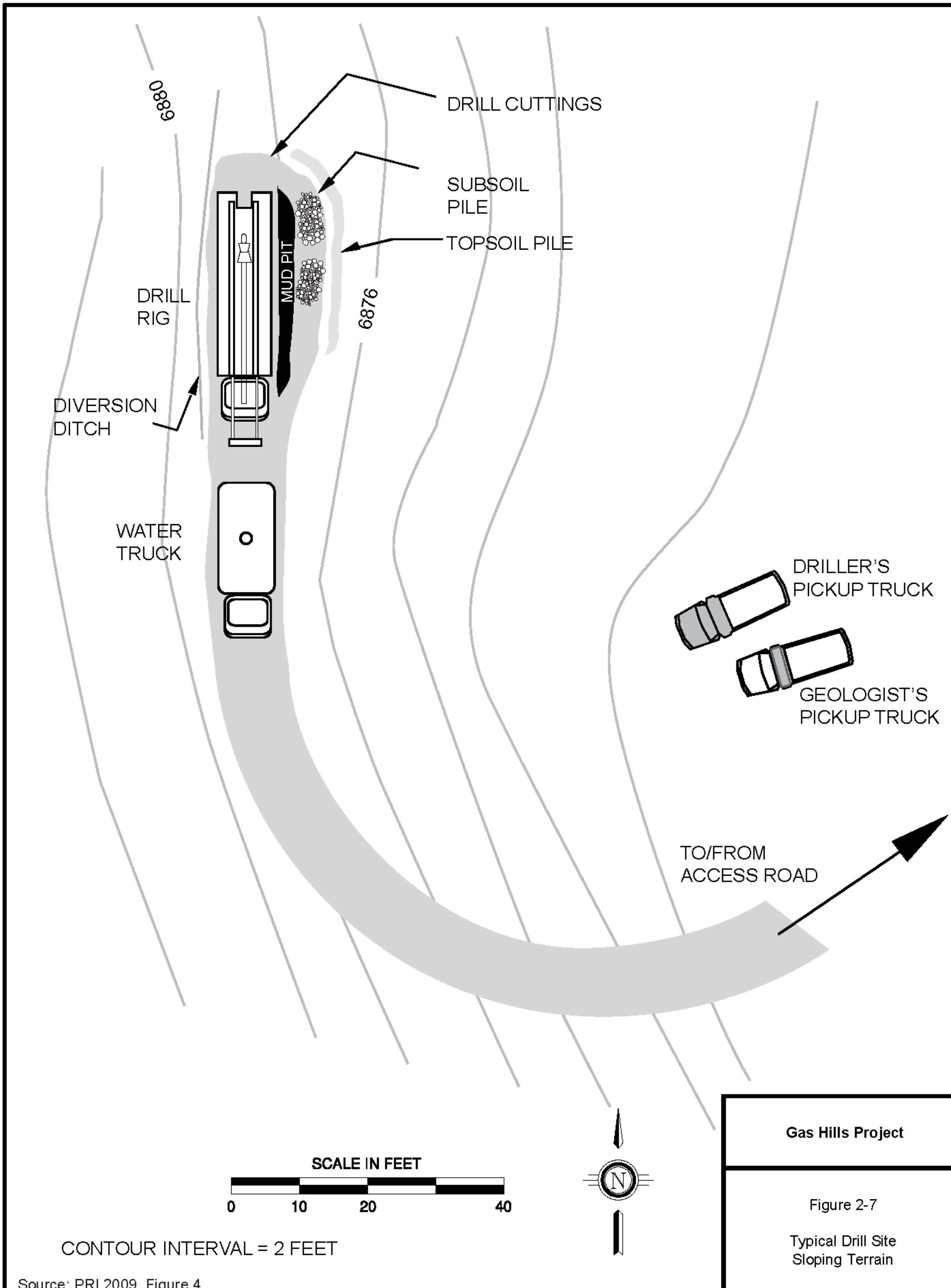


Source: PRI 2009, Figure 3.

Gas Hills Project

Figure 2-6

Typical Drill Site
Flat Terrain



Source: PRI 2009, Figure 4.

Gas Hills Project

Figure 2-7

Typical Drill Site
Sloping Terrain

perimeter monitoring wells and internal mine unit monitoring wells would allow for the collection of data to assess the uranium extraction activities and as an early indicator of potential excursions.

Surface disturbance caused by installation and completion of wells is described in the next section. Perimeter monitoring well disturbance would be similar to that caused by other types of wells but would include a 2-track access road to provide access to each well within the well ring surrounding each mine unit for short-term installation activities and long-term routine sampling. Perimeter monitoring well location and spacing would be determined using technically sound methods which could include, but not be limited to: hydrologic modeling; delineation drilling data; gradient consideration; dispersivity of recovery fluids; or the calculated operational flare and calculated excursion recoverability within 60 days. The density and spacing of perimeter monitoring wells would be determined for each mine unit during the detailed hydrologic testing of each mine unit. For the purposes of this analysis, the BLM has assumed that perimeter monitoring wells would be located approximately 400 feet outside of each mine unit boundary, and would be located approximately every 400 feet along that perimeter (**Figure 2-4**). Additionally, to calculate the estimated surface disturbance for perimeter monitoring wells by mine unit, each well would be assumed to be constructed within an 18-foot disturbance, and operated within a 10-foot disturbance for 2-track roads along the perimeter (**Table 2-1**).

2.3.2.3 Well Construction

An ISR development includes 3 types of wells; injection, production, and monitoring. **Appendix A, Figure A-1** illustrates a typical mine unit pattern installation. Topsoil from drill holes and drilling mud pits would be salvaged and placed in short-term stockpiles. Wells would be drilled and installed using truck-mounted rotary drilling rigs and water trucks. After an initial borehole is completed and the location determined to be viable for ISR, each well would be completed by expanding the hole to at least 3 inches larger than the outside diameter of the casing from the surface to near the top of the uranium ore zone. The hole would be cased with a polyvinyl chloride, fiberglass, or steel well casing that would extend from the top of the ore zone to approximately 2 feet above ground level.

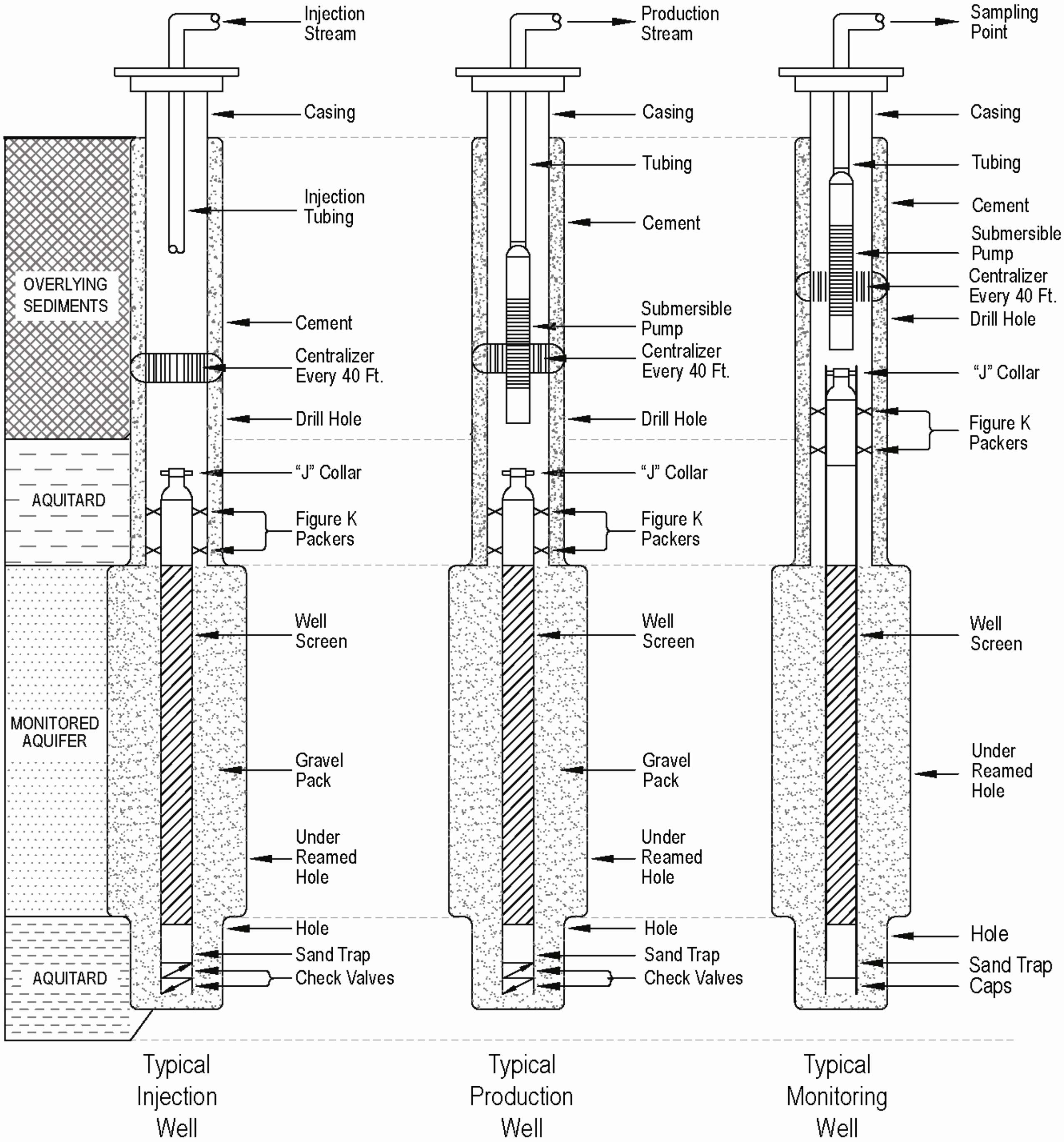
The casing would be grouted in place with sealing material (e.g., cement slurry). The sealing material would be pumped down through the casing and up the space between the wall of the drilled hole and the casing (annulus) of the well. The well casing would be pressure sealed and secured in place, and the sealing material allowed to cure. All wells would be constructed in such a manner to maintain well integrity and ensure that the well annulus is sufficiently sealed to prevent communication from the production zone to overlying and underlying aquifers penetrated by the well. See **Figure 2-8** for a cross section of a typical completed injection, production, and monitoring well.

Wells and associated facilities would require fencing. Similar to delineation drilling, well construction would include the use of temporary drilling mud pits. These drilling mud pits would be enclosed using "hog panels" consisting of 4 feet high by 16 feet wide rigid wire grid fence panels wired to steel T-posts. The panels would completely surround each mud pit to exclude animals and people from the drilling mud pit.

For the purposes of analysis in this EIS, surface disturbance as a result of well construction within the mine unit is captured within the total acreage of the mine unit, all of which is assumed to be disturbed during construction. See **Table 2-1** for these acreages as well as estimated acreage impacts from operations.

2.3.2.4 Access Roads, Header Houses, and Underground Utilities

Access roads within the mine units would provide access to the wells and supporting facilities inside each unit. Pipelines within the mine units would convey fluids between the wells and header houses and buried electrical lines within the mine units would provide necessary power to the facilities. The final location and number of header houses, access roads, and underground utilities within mine units would be determined based on results of delineation drilling and location of wells and support facilities.



Gas Hills Project

Figure 2-8

Typical Well Cross Section

Source: PRI 2009, Figures OP3-9, OP3-8, and OP3-10.

Appendix A, Figure A-1 illustrates a typical mine unit pattern installation. Similar to wells, acreage impacts from the construction of access roads and underground utilities within mine unit boundaries are captured by the overall acreage of the mine unit (**Table 2-1**). All mine unit roads would be either light use 2-track roads with a 10-foot width and a speed limit of 10 mph or secondary roads with a 15-foot width and a 30 mph speed limit.

Fluids would be conveyed between the satellite facility and mine units through buried pipelines to small central fluid distribution buildings called header houses within each mine unit where oxidant would be added to the injection fluid. Each header house would support approximately 20 production wells and 40 injection wells. ISR fluids extracted from production wells would flow back through the header houses to the satellite facility for treatment through a second set of buried pipelines. For an average production rate of 1 million pounds per year, 7 to 8 header houses and associated wells would be installed during a year.

While the construction disturbance acreage of the header houses would be captured within the overall mine unit acreage, disturbance remaining during operations would be approximately 12 feet by 25 feet for each header house (**Table 2-1**).

2.3.2.5 Interim Reclamation

Interim surface reclamation would occur after mine unit construction, to stabilize the disturbed soils during operations. Disturbed surfaces not used during mine unit operation for roads, header houses, or aboveground power lines would be scarified and contoured, if necessary, followed by topsoil placement and seeding with an approved seed mix.

Areas that have been compacted would be scarified, ripped, and/or disked as necessary to relieve the compaction and prepare for topsoil placement. Where necessary, the surface would be graded and contoured to approximate original contours and to blend with the surrounding topography. Topsoil would be placed in a single lift to avoid compaction. On steep slopes, topsoil would be placed along the contour.

The BLM-approved seed mix would reestablish a vegetative cover consistent with the existing land use of livestock grazing and wildlife habitat. Seeding would be conducted during the first available seeding window or during spring or fall using a pitting and seeding method, appropriate for arid rangelands. Other seeding methods may be used in limited areas where the pitting and seeding method would change surface water flow. After interim reclamation, noxious weeds would be controlled as needed by annual spraying by a certified applicator using a registered herbicide, typically in late spring or early summer, or as advised by the herbicide’s application instructions. Areas sprayed could include road cuts and fills, areas around buildings and fences, and isolated areas within recently constructed mine units.

The surface disturbance for wells generally would be reclaimed and seeded each year prior to disturbance associated with the following year’s construction. Reclamation of longer term disturbance associated with header houses and access road would not occur until after cessation of mining activities. The majority of lands within the mine unit would have undergone interim reclamation prior to uranium production.

The uranium processing and mine unit facilities would be fenced to exclude sheep and cattle from damaging or otherwise interrupting production infrastructure and activities. Processing and mine unit fencing would be constructed according to BLM Handbook H-1741-1 and WDEQ-LQD Guideline 10 to restrict livestock but allow wildlife access, including large game. The evaporation ponds would be fenced to prevent both livestock and large game animals from accessing the ponds. Fencing also would be installed to protect vegetated areas following interim reclamation occurring outside of mine units. All reclaimed areas would remain fenced for a period of at least 2 years or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization. Fencing would be removed after reclamation standards, described in Section 2.3.6, Final Project Reclamation and Decommissioning and Section 2.3.8, Existing Monitoring Plans, were met.

2.3.3 Mine Unit Operation

Mine unit operations would begin after construction of the first mine unit is completed or a portion of the mine unit sufficient to commence operation is completed. Once operations commence, they would continue on a 24 hour per day, 365 day per year basis until final closure. In addition to any BLM requirements, mine unit operations would be conducted under the jurisdiction of the WDEQ-LQD and the U.S. NRC.

2.3.3.1 In-situ Recovery

ISR involves the use of conventional water wells and a leaching solution, called a lixiviant, to extract the economic mineral from the geologic formation in which it occurs without physically removing the ore-bearing formation. The lixiviant consists of: 1) native groundwater to which has been added an oxidant, such as oxygen or hydrogen peroxide, to make the uranium soluble in the groundwater; and 2) a complexing ion, such as carbon dioxide or sodium bicarbonate, to which the uranium combines allowing it to be carried in groundwater pumped from the subsurface.

The lixiviant would be injected into the uranium-bearing layer through a series of injection wells. The lixiviant causes the uranium to go into solution with the native groundwater. The uranium-bearing groundwater would be recovered by pumping from production wells located adjacent to the injection wells. The uranium laden groundwater would be conveyed through buried pipelines to a surface ion-exchange system at the satellite facility. The uranium in solution attaches to ion-exchange resin beads, removing it from the groundwater. After the uranium has been removed, the majority of the water would be recycled back to the injection wells where the uranium extraction process would continue. The ion-exchange resin loaded with uranium would be transported to Cameco's Smith-Ranch Highland processing plant for further processing into a stable uranium concentrate powder (yellowcake).

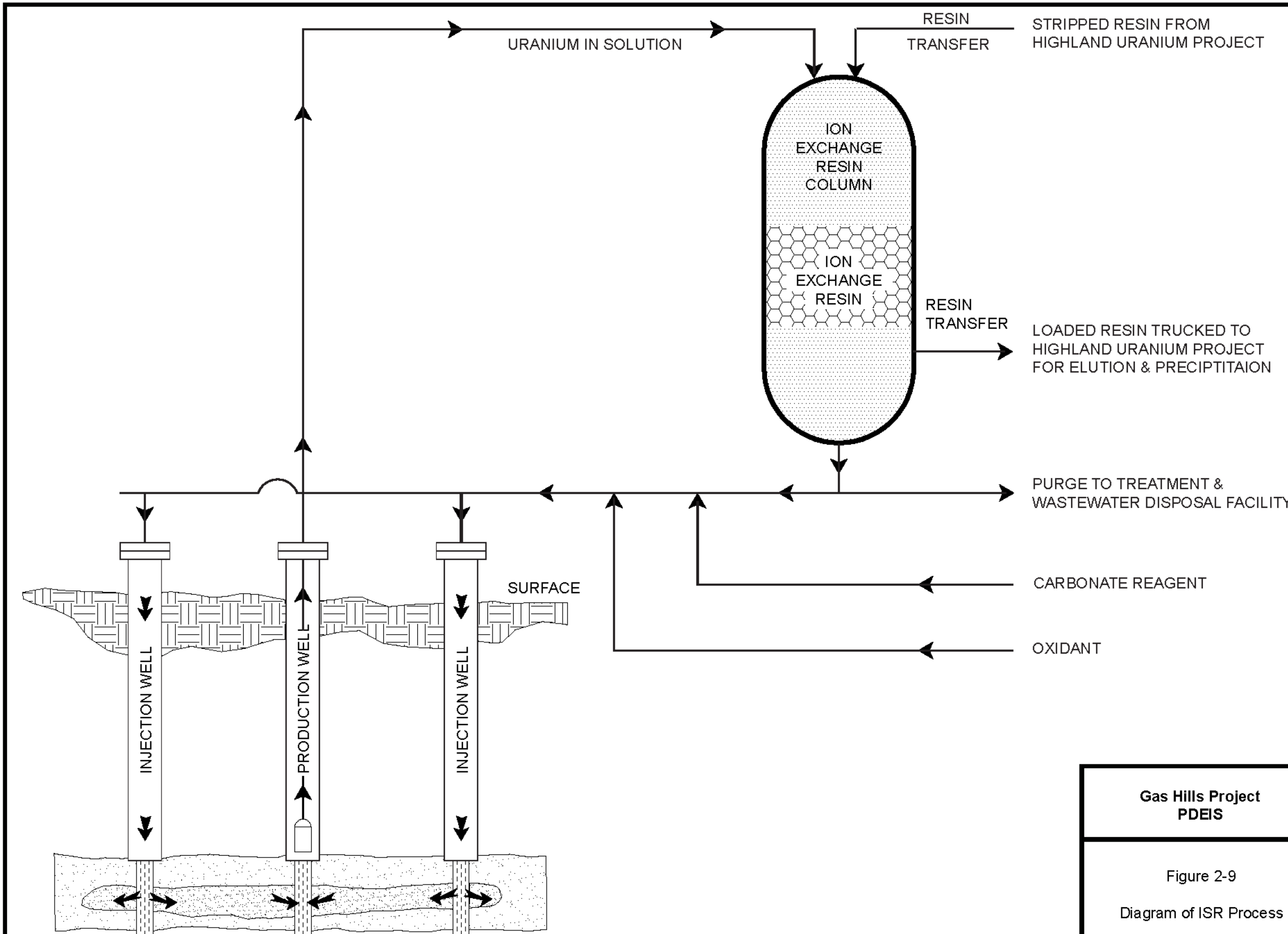
A schematic diagram of the ISR process is presented as **Figure 2-9**. After the economic recovery limit of a production zone has been reached, lixiviant injection would stop, and groundwater restoration of the production zone would start. Groundwater restoration involves returning the affected groundwater within the production zone to its pre-operational baseline water quality meeting the requirements of U.S. NRC and WDEQ-LQD rules and regulations, and is discussed in Section 2.3.5, Mine Unit Restoration and Reclamation, of this document.

A limited (approximately 1 percent) purge or "bleed" volume of water would be removed during the ISR process to maintain an inward groundwater flow within each mine unit. The result of this over-pumping would be creation of small cones of depression centered on production wells within the mine unit. These cones of depression would collectively prevent both injected chemicals and leached ore from migrating into the area surrounding each mine unit. Bleed water would be disposed of as waste water as described in Section 2.3.1.2, Waste Management.

2.3.3.2 Monitoring and Reporting

Unintended spread of lixiviant beyond the boundaries of the mine unit within the groundwater is called an excursion. Excursions could occur horizontally within the uranium-bearing layer (lateral movement of lixiviant away from the production zone), or vertically (lixiviant crossing less permeable confining strata and migrating into aquifers above or below the producing zone).

U.S. NRC licenses and WDEQ permits require periodic testing of water from monitoring wells for early identification of excursions. Monitoring wells would be located horizontally outside of the mine unit and within the production zone, and vertically above and below the production zone in adjacent aquifers, based on a design approved by WDEQ. Water samples would be collected from monitoring wells at least



Source: PRI 2009, Figure 2.

Gas Hills Project
PDEIS

Figure 2-9

Diagram of ISR Process

every 2 weeks during operation to test for excursions of lixiviant-bearing solutions. In addition, mechanical integrity testing would be performed before a production well is brought on-line and every 5 years during operation, to verify the well casing has no leaks. Should leaks or excursions be identified and confirmed, Cameco would be required to correct the excursion using methods approved by U.S. NRC and WDEQ. Corrective actions could include adjusting the rate of injection and pumping of lixiviant-bearing solutions, establishment of capture wells to limit any movement of the excursion, and cessation of ISR activities in the mine unit. Selection and approval of corrective actions to manage excursions would be within the jurisdiction of the U.S. NRC and WDEQ, rather than the BLM.

2.3.3.3 Transportation

Primary access to the GHPA would be either via State Highway 136 from Riverton or by Fremont County Road 212 from Waltman. Ion-exchange resin loaded with uranium would be transported to Cameco's Smith-Ranch Highland processing plant for stripping and processing into yellowcake. The stripped resin would be transported back to the GHPA for reuse. Transportation of resin (including container and vehicle specifications) would be conducted under the jurisdiction of U.S. NRC and the USDOT. Cameco estimates that, during the period of uranium recovery operations, 1 truck would make the roundtrip once per day with approximately 500 cubic feet of resin. The interstate highway, U.S. highways, and state highways are maintained year round.

Up to 20 deliveries of materials supporting the Project (e.g., sodium bicarbonate, carbon dioxide, oxygen, hydrochloric acid, or propane) would occur per week during operations. Commercial delivery services would provide general shipping services an estimated 3 times per week. In addition, traffic would include up to an estimated 23 heavy trucks per day and 54 light trucks per day, generally for employees and construction workers.

County and private roads could be impassable or closed during inclement weather. On-site storage capacity for raw materials and product would be constructed to cover 7 consecutive days of road closures. Should roads remain impassable for that period or longer, Cameco would contract with road maintenance crews to provide passage.

2.3.4 Personnel/Work Force

The Project would employ a mix of full-time personnel and contractors throughout the life of the mine. Approximately 20 full time employees and 20 contractors would be hired in the first year of the Project. Contractor personnel would include employees of companies conducting work at the site (typically drilling and construction) under contract to Cameco, and would remain at the same level through year 20. The Project would employ approximately 65 full-time workers from year 2 through year 19, tapering down to 50 in years 20 and 21, and 40 full-time personnel through the final year of the Project. It is likely that a majority of the workers would live in Riverton or Casper. The Project would contribute to public revenues through payment of taxes to federal, state, and local governments, including income taxes, mineral severance taxes, property taxes, and sales taxes.

2.3.5 Mine Unit Restoration and Reclamation

Final reclamation of mine units generally consists of 2 major activities:

- Groundwater restoration; and
- Final mine unit surface reclamation.

Mine unit groundwater restoration and surface reclamation would occur while construction or operations occur in other mine units. Once the economic recovery limit of any mine unit has been reached, uranium recovery operations would cease, and groundwater restoration would commence. After groundwater within a mine unit has been restored to pre-operational baseline water quality or an alternative concentration limit approved by the U.S. NRC, removal of mine unit infrastructure and final surface reclamation would be implemented. Groundwater restoration would be approved under the jurisdiction of WDEQ-LQD and the U.S. NRC while surface reclamation would be conducted under the jurisdiction of WDEQ-LQD, U.S. NRC, and the BLM. Activities at each mine unit, from construction through operation and the end of final surface reclamation, is estimated to take 10 to 13 years, based on currently estimated initial and maximum production rates and on the anticipated time frame for groundwater restoration. Production rates would be adjusted in response to actual mine unit well flows, uranium recovery rates, the market demand for uranium, and the actual rate of groundwater restoration. These adjustments potentially would affect the estimated time to final surface reclamation.

2.3.5.1 Groundwater Restoration

Restoration of groundwater to pre-mining quality would be a sequenced, phased process using Best Practicable Technology (BPT). The goal of groundwater restoration would be to return the affected groundwater within the production zone to pre-operational baseline water quality. For affected groundwater outside the production zone, an evaluation would be performed on a well-by-well basis. Additionally, water outside the aquifer exemption boundary must be protected to applicable USEPA maximum contaminant levels per 40 CFR 141, as amended July 1, 2001 DEQ Rules and Regulations Chapter 11, Section 5(a)(ii)(B) through (D).

Groundwater restoration would use the existing mine infrastructure and would not require additional construction. Production wells would be switched to groundwater restoration, and water flow would be conveyed through existing piping and header houses. Groundwater restoration would be accomplished using several methods such as groundwater sweep, reinjection of groundwater treated by RO, bioremediation, or addition of reducing chemicals. Groundwater restoration is currently estimated to take 4.5 to 7.5 years to achieve within a given mine unit; however, restoration activities would continue until stability is achieved and regulatory concurrence has been granted by WDEQ-LQD and U.S. NRC.

Methodology

At the beginning of groundwater restoration, the wells sampled for baseline water quality would be resampled and analyzed to characterize an "end of mining" water quality average. The wells would be sampled annually and analyzed for pH, total dissolved solids (TDS), cations (calcium, magnesium, sodium, potassium, ammonia, barium, strontium), and anions (carbon trioxide, bicarbonate, sulfate, chloride, fluoride, nitrogen trioxide, silicon dioxide). To track the progress of restoration, the wells also would be sampled monthly and analyzed for conductivity, chloride, and uranium during periods of active restoration.

A combination of the following groundwater restoration tools may be necessary to return the quality of water to pre-operational baseline conditions utilizing BPT, including the following.

1. **Groundwater Sweep:** Water would be pumped from the wellfield to the processing plant through all production and injection wells without reinjection. Uncontaminated native groundwater flows into the ore body, thereby flushing the contaminants from areas that have been affected by the uranium recovery process. Groundwater produced during the sweep phase would initially contain uranium and other contaminants mobilized during the uranium recovery phase, but would decline gradually with time. Groundwater produced during the sweep phase would be treated using RO technology with the treated water being recycled and used as lixivant in the remaining mine units, and the brine being disposed of by evaporation or deep well-disposal by injection.
2. **Groundwater Treatment and Re-injection:** Groundwater pumped from the wellfield would be treated. The filtered water would be re-injected into the wellfield, further reducing lixiviant volumes and ion concentrations. The RO capacity would be sized to meet the water needs for the restoration process.
3. **Biological Reductant and/or Chemical Reductant Treatment:** Biological nutrients (e.g., molasses or ethanol) or a chemical reductant (e.g., sodium sulfide) would be added to water

being pumped through the formation to create a reducing environment, so the remaining dissolved uranium would precipitate out of solution.

4. **Chemical Treatment for pH (if required):** Final adjustment of pH may be required to assist in immobilizing certain ions, particularly metals. Adjustment of pH would be achieved by adding chemicals such as potassium hydroxide or sodium hydroxide into the uranium production zone during the later stages of groundwater restoration to return the aquifer to the original pH.

During operations and groundwater restoration, the wastewater treatment would take place at the Carol Shop or the second satellite facility.

The proposed groundwater restoration methodology is based on current, industry-wide practices and innovations. As groundwater restoration technology continues to evolve, alternative restoration methods that could accelerate and/or improve groundwater restoration success would be considered and evaluated. Regulatory approval from WDEQ-LQD would be obtained prior to initiating any alternative restoration method.

Stability Monitoring after Groundwater Restoration

Following concurrence that groundwater restoration has been achieved in a particular mine unit by WDEQ-LQD, groundwater quality would be monitored for an additional 12-month period to ensure that the restored groundwater quality remains stable. Stability monitoring would involve collection of samples from all monitoring wells at the beginning of the stability period, collection of samples from monitoring wells within the production zone once every 2 months, and collection of samples from perimeter monitoring wells on a monthly basis.

At the end of the stability period, monitoring data would be evaluated to determine the success of the groundwater restoration effort. Cameco would provide a restoration report to WDEQ-LQD and U.S. NRC containing the data evaluation and an analysis of the restoration effort. The agencies would review the reports and determine whether restoration was successful, whether more stability sampling would be required, or whether additional active restoration would be required.

2.3.5.2 Final Mine Unit Surface Reclamation

Once Cameco has restored the groundwater within a mine unit to target water quality approved by the U.S. NRC and WDEQ-LQD, final surface reclamation would be implemented. Wells would be plugged and abandoned, followed by the removal of subsurface infrastructure (i.e., buried pipelines, power lines, and other utilities) and surface facilities (i.e., aboveground power lines, header houses, and roads) and minor site grading. This activity would involve re-disturbing the entire mine unit surface. Removal of infrastructure would then be followed by final surface reclamation and revegetation operations. Reclamation of mining-related surface disturbances in any mine unit would be implemented, and should be trending towards reclamation success within 2 years following approval by the WDEQ-LQD and U.S. NRC of groundwater restoration in that mine unit.

All wells would be abandoned in accordance with WDEQ-LQD Rules and Regulations. Wells would be sealed from bottom to top with an approved abandonment fluid (e.g., cement slurry). The soil around the well casing would be excavated to at least 2 feet below ground surface, the casing would be cut off, and a concrete plug would be placed on top of the casing. The excavated area around the abandoned well would be backfilled with the excavated material to the original surface and seeded with the approved seed mix.

2.3.6 Final Project Reclamation and Decommissioning

Following completion of mining and groundwater restoration activities at all mine units Cameco would decommission and reclaim all facilities and other mining-related disturbance outside of the mine unit boundaries. The goal of this activity would be to return those surface areas affected by ISR activities to a condition which would support the pre-mining land use of livestock grazing and wildlife habitat. Reclamation activities (i.e., decommissioning, grading, topsoil application, and seeding) for all mining-related surface disturbances would be completed within 2 years following approval of final groundwater restoration within the GHPA. Final reclamation would be deemed complete and successful based upon criteria detailed in Section 2.3.9, Applicant-committed Environmental Protection Measures and in reclamation standards outlined in the Lander RMP (BLM 1987). All reclaimed areas would remain fenced for a period of at least 2 years, or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization. The fencing would not be removed until the BLM and WDEQ-LQD agree that the revegetated areas are ready for livestock grazing.

Those facilities requiring decommissioning and removal following the completion of groundwater restoration of the entire Project include, but are not limited to:

1. Buildings and structures, including the Carol Shop facility and the additional satellite facility (if constructed);
2. Process and water treatment facilities housed within these structures including tanks, piping (aboveground), pumps, and related equipment;
3. Buried piping including piping between mine units and process and water treatment facilities, and piping between the Carol Shop facility or the additional satellite facility and the evaporation ponds or wastewater disposal well(s);
4. Evaporation ponds and/or wastewater disposal well(s);
5. Overhead and buried power lines; and
6. Access roads.

Prior to final reclamation, all radiologically contaminated portions of buildings, process vessels, and other structures and affected areas would be decontaminated to U.S. NRC unrestricted release standards or, if decontamination is not possible, removed to a disposal facility licensed by the U.S. NRC to receive such material. Radiological surveys would be conducted following radiological decontamination to verify that areas affected by the Project meet U.S. NRC decommissioning criteria. Note that there are areas that currently have elevated radiological levels, namely the previously mined areas and their associated access roads.

Prior to demolition of buildings and structures within the GHPA (including the Carol Shop facility, satellite facilities, and pump stations), all equipment would be removed. Any contaminated materials would be decontaminated or removed for disposal at an U.S. NRC-licensed facility. Buildings and structures would be dismantled and removed from the GHPA either for disposal at an appropriately licensed solid waste facility or for salvage.

All buried piping would be removed from the GHPA. Contaminated materials would be disposed at an U.S. NRC-licensed facility. Non-contaminated material would be disposed at an appropriately licensed facility and/or would be removed for salvage. Removal of piping would re-disturb pipeline ROWs which then would be reclaimed and seeded.

Upon completion of use, and evaporation of excess liquid, solid wastes contained in the evaporation ponds, as well as the primary liner, would be removed and disposed of at an U.S. NRC-licensed disposal facility as described in Section 2.3.1.2, Waste Management. The underlying leak detection system and secondary liner would be surveyed and tested for contamination. Any portion of the leak detection system, secondary liner, and/or underlying materials that did not meet U.S. NRC decommissioning criteria would be excavated and removed for disposal at an U.S. NRC-licensed facility.

Portions of the leak detection system which met U.S. NRC decommissioning criteria would be covered with a minimum of 4 feet of overburden and topsoil and reclaimed in place. Any uncontaminated solid waste material which could be detrimental to site reclamation would be removed and disposed of at an appropriately licensed facility. Following cleanup of the site and removal of contaminated materials, the evaporation ponds would be graded to their approximate original contour. Grading would include the replacement of material excavated during the construction of the evaporation ponds. Topsoil would then be replaced and the area reclaimed to the final reclamation standards presented in the applicant-committed environmental protection measures.

All buried and overhead power lines would be removed from within the GHPA. Removal of buried lines and power poles would re-disturb power line ROWs which then would be reclaimed and seeded.

Prior to reclamation, all roads would be surveyed for radiological contamination in excess of radiological levels documented as pre-existing baseline conditions. Any contamination resulting from the ISR operation would be cleaned to appropriate U.S. NRC standards and the contaminated material disposed of at an U.S. NRC-licensed facility. Following decontamination, roads would be ripped and/or disked to relieve compaction. Excess imported gravel would be removed. Culverts would be removed and pre-mine drainages reestablished. All roads and ditches to be reclaimed would be graded and contoured to blend with the surrounding terrain.

Those portions of roads utilized for access to the site, facilities, and mine units, including the AML road, the Carol Shop Road, and constructed access roads, would be reclaimed unless landowners and lessees request that the roads be left for future access and accept the responsibility for their long-term maintenance and ultimate reclamation.

2.3.7 Temporary Closures

U.S. NRC regulations allow for the placement of uranium ISR facilities on standby for up to a 24-month period. If operations have not resumed by the end of the 24-month period, Cameco would be required to proceed with Project decommissioning unless a request for a time extension was submitted to and approved by the U.S. NRC. Temporary closures during the operational life of the Project, while not expected, could occur under specific economic conditions. This section discusses the sequence of activities that would take place in the event of a temporary closure.

An economic downturn in the uranium market that would render the Project unprofitable would cause a temporary cessation of uranium production. In addition, if Cameco were to decide to end the Project early, activities at the mine could not stop immediately. The following actions would take place:

- Delineation drilling would cease and surface disturbances would be reclaimed in accordance with the applicant-committed environmental protection measures in Section 2.3.9, Applicant-committed Environmental Protection Measures;
- Mine unit development and construction would cease;
- Producing mine units would continue in the production mode until the uranium resource was depleted, at which time they would proceed into the groundwater restoration phase;
- Mine units in groundwater restoration would continue in that mode until regulatory requirements for restoration was achieved; and,
- Once groundwater restoration was completed and approved, surface reclamation and decommissioning would be completed on a mine unit by-mine unit basis until all mine units were decommissioned.

Once these activities were completed, Cameco would make a business decision as to whether to proceed to final reclamation or to keep the main injection/recovery trunk lines and uranium recovery facilities in place in anticipation of a future production restart. A decision to keep these facilities in place for an extended care and maintenance period would result in the following actions by Cameco:

- Main trunk lines to the uranium recovery facility would be drained and the excess water would be treated and disposed of.
- Open ends of the pipelines would be sealed, and manholes would be secured from access by securing the lids to the manholes and locking the access hatches.
- Plant equipment, including reagent tanks, would be drained, decontaminated, and protected for future use.
- Interior building surfaces would be decontaminated and cleaned.
- Solids would be removed from the evaporation ponds and properly disposed, and the pond liner surfaces would be decontaminated and cleaned.
- Fuel storage tanks would be removed from the site and the storage areas would be reclaimed.
- Buildings and ponds would be secured from public and animal access using fences and by securely locking access doors.
- Facilities would be inspected on a monthly basis. The inspected areas would include restricted access to radiological areas, evaporation ponds, mine units, and perimeter fences.
- Any discovered breach of site infrastructure would be reported to the proper regulatory and law enforcement authorities by Cameco. Potential hazards resulting from the breach would be assessed, documented, and reported as required. The breached area would be re-secured as necessary.
- A remote alarm and monitoring system would be considered if the technology was determined practicable at such a remote location.

2.3.8 Existing Monitoring Plans

A monitoring program has been developed by Cameco and approved by WDEQ-LQD and U.S. NRC to monitor the effects of the Project. The objectives of the monitoring program would be to: 1) demonstrate compliance with the monitoring plan and ensure compliance with other state and federal regulations and laws; 2) provide early detection of potential problems; and 3) supply information that would assist in directing corrective actions should they become necessary.

The Project surface and groundwater monitoring programs for pre-operational, operational, and post operational monitoring are detailed in the Operations Plan (PRI 2009). A detailed surface and groundwater sampling and analysis plan also is part of the LQD requirements. The following sections summarize the major elements of these monitoring plans.

Surface and Groundwater Monitoring

The predominant natural surface water flowing through the permitted area is West Canyon Creek (WCC), which is considered to be a perennial stream. Although the spring flows year round, only about 1.7 miles of the Creek flows on a perennial basis. With the exception of WCC, most drainages throughout the property are intermittent and ephemeral in nature, and flow only in response to spring run-off or occasional thunderstorms.

Baseline surface water conditions would be characterized based on samples collected from 6 surface water locations prior to construction of mine facilities: WCC-1, WCC-2, WCC-3 on WCC; Cameron Spring; and 2 locations in Fraser Draw denoted as WFD and EF. Results from these locations would be used to compare results from monitoring during the life of the Project.

Three surface water sites and 1 groundwater site would be routinely monitored during the life of the Project as part of the area-wide monitoring program. These sites would include the following:

- Cameron Spring Reservoir which is located south and up-gradient of the proposed Mine Unit 1 in the SESE Qtr/Qtr of Section 2, T32N, R90W. Monitoring would include discharge rate and water quality from the spring;
- Stock Pond in Section 32, a small constructed pond near the northern end of proposed Mine Unit 1, in the SWNE Qtr/Qtr of Section 32, T33N, R89W. Monitoring would include quarterly grab samples that would be analyzed for conductivity, pH, natural uranium, and radium-226;
- WCC which flows through proposed Mine Unit 4 has 2 established surface water monitoring stations. Monitoring would include quarterly grab samples at the start of Mine Unit 4 construction; and
- The current drinking water supply well for the Carol Shop facility would be plugged and abandoned due to high radium concentrations. Cameco intends to drill a new supply well for the Carol Shop facility under a separately permitted action, and as permitted by the Wyoming State Engineer's Office. Currently, Cameco anticipates the water would come from formations below the Wind River Formation, either from the Nugget Sandstone formation, or from a formation within the Chugwater group. Monitoring of the new well would follow the requirements of the permit and the U.S. NRC license stated for the existing drinking water supply well.

Additional monitoring wells would be installed as part of mine unit development and would include perimeter wells that surround and monitor the mine unit as well as wells to monitor overlying and underlying aquifers. A network of regional groundwater monitoring wells already exists at the GHPA that was previously sampled and measured to establish pre-mining baseline groundwater quality and limited static groundwater elevations.

Post-operational Vegetation Monitoring

Project monitoring also would include post-operational vegetation monitoring. The reclamation goal within the GHPA would be to return the land to a condition that would sustain the pre-mining land use of livestock grazing and wildlife habitat. The success of revegetation in meeting the land use goal would be assessed prior to application for bond release by using the Comparison Area (COMA) method as described in State of Wyoming regulations. A COMA is defined as a land unit which is representative, in terms of physiography, soils, vegetation, and land use history, of a plant community where the pre-mining total vegetation cover and species diversity has not been collected, or where the area to be affected is small and incidental to the operation. The representative nature of each COMA is validated by a subjective field reconnaissance of the site or by subjective evaluation of the vegetation data generated by a sampling program. Post-mining quantitative data from the COMAs would be directly compared, by standard statistical procedures, to data from a reclaimed vegetation type when evaluating revegetation success for full bond release.

Revegetation would be considered successful when, at the end of the bonding period, the following have been demonstrated:

- Vegetation species of the reclaimed land are self-renewing under natural conditions prevailing at the site;
- Total vegetation cover of perennial species (excluding noxious weed species) and any species in the approved seed mix is at least equal to the total vegetation cover of perennial species (excluding noxious weed species) on the area before mining;
- Species composition and diversity are suitable for the approved post-mining land use; and
- The above criteria are achieved during 1 growing season, based on observations collected no sooner than the fifth full growing season following reclamation.

Further details of vegetative success criteria are listed in Section 2.3.9, Applicant-committed Environmental Protection Measures.

Air Monitoring

Cameco would maintain a continuous air monitoring program at locations upwind and downwind relative to the permit boundary in order to ensure compliance with U.S. NRC regulations 10 CFR 20.1301, 20.1302, and 20.1501. The air monitoring program would include passive gamma and radon monitoring devices. Air particulate air sampling also would be conducted.

Wildlife Monitoring

Wildlife also would be included as a component of monitoring at the mine. Wildlife surveys were conducted in 1992, 1993, 1994, 1996, 1997, 1999, and 2007 and provide baseline information. These annual wildlife surveys were reinitiated by Cameco in 2009, 2010, and 2011, and reports were provided to the WDEQ and the BLM.

A Wildlife Monitoring Plan was prepared in consultation with and approved by the BLM, the lead agency for Project-related wildlife issues, as well as the WGFD and the USFWS. The plan describes the methodology and frequency of annual monitoring as well as listing the specific species to be monitored. The plan would be reviewed annually with the BLM to address any necessary changes. The most recent update was submitted for BLM approval on July 22, 2011.

Annual surveys that are part of the revised monitoring plan include: occupied sage-grouse leks within 2 miles of the GHPA, active raptor nests within 1 mile of the GHPA, mountain plover presence/absence surveys in known habitat within 0.25 mile of the GHPA, and surveys for burrowing owl occurrence and sign. Opportunistic sightings of other wildlife species also would be included in annual reporting. After construction of the evaporation ponds, Cameco would monitor potential waterfowl activities in and around the ponds and would be required to report any migratory bird losses.

2.3.9 Applicant-committed Environmental Protection Measures

Applicant-committed environmental protection measures included in Cameco's PoO (PRI 2011a) or Mine Permit Application (PRI 2009) that would avoid, minimize, or mitigate impacts due to the Proposed Action are provided in the following sections.

General Construction

- Both primary and secondary access roads would use culvert crossings at drainages.
- Topsoil would be placed in a single lift to avoid compaction. On slopes of 4:1 (horizontal to vertical) or steeper, topsoil would be placed along the contour. Topsoil would not be placed under excessive wet, dry, or frozen ground conditions which would cause excessive clod or frost chunks to form. Topsoil thicknesses would reflect the approximate thicknesses of topsoil originally available at the locality being reclaimed. All salvaged topsoil would be utilized for reclamation purposes.
- Topsoil information would be provided to WDEQ-LQD, together with proposed stripping depths, as part of the Hydrological Test Proposal for each mine unit. In those cases where topsoil stripping would be necessary, such as a major road or building site, site-specific topsoil thickness and suitability evaluations would be performed utilizing either drill borings or backhoe excavations. Topsoil stripping depths would be based on visual observation and the results of chemical analyses, and would be field staked prior to salvage operations. Topsoil depth and suitability determinations would be made by persons qualified by education and/or training to make such determinations. The maximum stripping depth would be 12 inches for all excavations, except for mud pits and evaporation pond sites, which would have all suitable material salvaged and stockpiled.
- Typical long term topsoil stockpiles would be large, contain topsoil for more than 1 year and result from the excavation of building sites, evaporation ponds, culvert crossings, and primary and secondary access roads. These stockpiles would be constructed with 3:1 or flatter side

slopes and would be seeded on the contour as soon as possible after construction using only the grass species of the BLM and WDEQ-LQD approved permanent seed mix. All long-term stockpiles would be bermed along the bottom to control sediment runoff and would be identified with highly visible signs containing the word "TOPSOIL" in letters at least 6 inches high. The signs would be placed on stockpile approach roads not more than 150 feet from the stockpile. Locations of long-term stockpiles and their volumes would be included in each LQD Annual Report.

  - The need to conduct nutrient analyses of topsoil that has been stockpiled for more than one year would be assessed prior to redistribution of the topsoil. The size and depth of the stockpile, the amount of vegetation growth present, and the length of time the topsoil was stored would be taken into consideration. Nutrient analyses would not be performed on stockpiles that were less than 5 feet thick as the microbial activity within the soil would be maintained because of the limited thickness and resultant compaction. If after two growing seasons following topsoil application and seeding, revegetation problems are identified, nutrient analyses would be performed. Should the analyses indicate a nutrient deficiency, the area would be fertilized and reseeded.

- Typical short-term topsoil stockpiles result from excavation of drill hole and well mud pits. Typically, topsoil would remain in short term stockpiles for no more than 6 months. This would allow for direct replacement of "live topsoil" on the disturbed surface. Except for small short-term stockpiles which would be constructed with gentle side slopes, the perimeter of long-term topsoil stockpiles would be bermed to control sediment runoff. Additionally, large topsoil stockpiles, such as those that would result from the excavation of large building sites and the evaporation ponds, would be constructed with 3:1 or flatter side slopes and would be seeded on the contour.
- Following completion of delineation drilling, wellfield design would locate injection and recovery wells outside the boundary of wetlands. Under the Proposed Action, wetlands temporarily could be disturbed for construction of roads. Cameco would work with the WDEQ and U.S. Army Corps of Engineers (USACE) to define jurisdictional wetlands, and comply with the Section 404 or Section 401 permitting process, as appropriate. These processes would include development of a mitigation plan.
- Aboveground facilities would be painted with low-reflectivity paints in colors that would blend with the natural environment. The BLM color chart would be consulted in selecting an appropriate paint color or colors.

Mine Unit Construction

- The drilling mud pits would be fenced using 4 feet high by 16 feet wide rigid wire grid fence panels wired to steel T-posts (hog panels) protect from human and animal intrusion until the contained fluid was removed or evaporated, at which time the pits would be reclaimed and the fencing removed.
- Topsoil would be separately stockpiled within the mine unit disturbance area and replaced after well construction completion.
- Pre-construction contours would be restored and reclaimed after a well was constructed.
- All areas disturbed for mine unit well, pipeline, and utility trenches would be reclaimed and revegetated as soon as possible after construction was completed.
- All fencing installed at the Project would be of a temporary nature to protect the wellfield areas during operations and to protect vegetated areas following reclamation. Fence design and specifications would follow the BLM specifications as they are the dominant land owner within the permit area.

Storm Water Management

- Sedimentation would be controlled through the use of erosion control and channel stabilizing measures such as:
  - ditches and berms;
  - conveyance channels;
  - rock/rip rap;
  - outlet protection;
  - sediment traps or basins;
  - straw bale barriers;
  - silt fence; and
  - check dams.
- All long-term topsoil stockpiles (e.g., soil removed from building areas, access roads, etc.) would be fully contained and vegetated. A containment ditch and berm would be constructed at the base of each stockpile to prevent any loss of topsoil before new vegetation could be established.
- All available disturbed areas, including topsoil piles, road cuts, etc. would be seeded with the approved seed mix at the first appropriate season, spring or fall, to control erosion and protect the topsoil resource. Should weather or other conditions prohibit disturbed areas from being seeded for more than 3 months, the area would be scarified with a disc, chisel plow, or similar apparatus, or mulched with a straw mulch crimped at a rate of 2 tons per acre, to assist in conserving the topsoil resource until seeding can be accomplished. The establishment of a temporary cover crop, such as barley, winter wheat, millet, or rye seeded at 30 pounds per acre also could be utilized to assist in protecting the topsoil resource.
- Areas with slopes greater than 25 percent would be mulched with straw mulch crimped at a rate of 2 tons per acre or planted with a temporary cover crop as soon as possible to assist in preventing erosion. Geotextile "mulched matting" and select erosion control products would be utilized on areas where erosion control and vegetation establishment is particularly difficult. BMPs would be utilized to control sediment loss from stripped and or recently topsoiled and seeded areas.
- Fuel storage areas would be managed to prevent off-site drainage to or from the area. All petroleum products stored at the site would be contained in approved and appropriately labeled aboveground containers. Secondary containment would be accomplished by berming and/or ditching the perimeter of the entire fuel storage area.
- For exposed soil areas where construction activities were temporarily ceased for a period of 28 days or more, temporary stabilization measures would be implemented. These measures could include surface roughening, cover crop plantings, mulching or erosion control blankets. Temporary erosion protection would be especially important for areas containing graded slopes, ditches, berms, and soil stockpiles. The primary method of revegetation would be the pitting and seeding method. To the extent possible, crossing perennial and intermittent drainages with drill equipment and vehicles would be avoided. If it became necessary to cross a drainage to reach a drilling site, a temporary stream crossing would be constructed at right angles to the channel with adequate embankment protection and installation of properly sized culverts. Once the drill location was reclaimed and seeded, the stream crossing would be removed and any surface damage reclaimed and seeded.
- Mobilization of the drill rig from hole to hole would be restricted to dry or frozen ground conditions.

- During active construction, qualified personnel would inspect disturbed areas, control measures, and locations where vehicles entered or exited the site, at least once every 14 calendar days and within 24 hours of the end of any precipitation and/or snow melt event which exceeds 0.5 inches. During seasonal shutdowns qualified personnel would inspect the site at least once every month, unless snow cover or frozen ground conditions exist over the entire site for an extended period with no melting conditions.

<u>Operation</u>

- Fences surrounding evaporation ponds would be constructed to prevent both livestock and wildlife from accessing the ponds.
- Long-term fencing would be constructed around the mine unit production facilities and processing satellites that would prevent access by sheep and cattle but still would allow wildlife access to forage (Section 2.3.2.5, Interim Reclamation).
- Mine unit fluid spills that could contaminate surface soils would be minimized through the use of proper construction and operational procedures, detection devices and alarms, and proper training of personnel.
- Cameco would monitor waterfowl activity at the evaporation ponds during operation:
  - Should it become necessary, Cameco would implement actions to remove, exclude, and deter waterfowl using methods including, but not limited to propane cannons, netting over the ponds, and brightly colored pennants.
- Proposed mitigation for raptor nests could include construction of alternate nest sites on natural features, or the erection of appropriately sized nesting platforms.
- Site speed limits of 40 mph on primary roads, 30 mph on secondary roads, and 10 mph on 2-track roads would be implemented to reduce wildlife/vehicle collisions and generation of dust.

<u>Decommissioning</u>

- All reclaimed areas would remain fenced for a period of at least 2 years, or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization:
  - The fencing would not be removed until the BLM and WDEQ agreed that the revegetated areas are ready for livestock grazing.
- Buildings and structures would be dismantled and removed from the Project and would be salvaged or disposed of at an appropriately licensed solid waste facility.
- Radiological surveys would be conducted following any radiological decontamination to verify that areas affected by the Project meet U.S. NRC decommissioning criteria.

<u>Reclamation</u>

- During final reclamation buildings, structures, well, pump stations, overhead and buried power lines, evaporation ponds, and buried piping would be removed.
- Following cleanup of the site and removal of contaminated materials, the evaporation ponds would be graded to their approximate original contour. Grading would include the replacement of approximately 56,400 cubic yards of material excavated during the construction of the evaporation ponds. Topsoil would be replaced and the area seeded.
- Following decontamination, the roads would be ripped and/or disked to relieve compaction. Excess imported gravel would be removed. Culverts would be removed and pre-mine drainages

reestablished. All roads and ditches to be reclaimed would be graded and contoured to blend with the surrounding terrain.

- All disturbed surfaces would be scarified and contoured, if necessary, followed by topsoil placement and seeding with the approved seed mix.
- Areas which were compacted would be scarified, ripped, and/or disked as necessary to relieve the compaction and prepare the sub grade for topsoil placement. Where needed, the surface would be graded and contoured to approximate original contours and to blend with the surrounding topography. In areas that were stripped of topsoil, the salvaged topsoil would be re-applied in a single lift to avoid compaction. If necessary, the replaced topsoil would be disked to create a proper seed bed. Seed bed preparation would only be performed under appropriate soil and climatic conditions.
- The seed mixture used would be comparable to mixes used on other reclamation mines in the area, and was approved by the WDEQ-LQD and the BLM in 2008. This mix was designed to establish a vegetative cover consistent with the pre-mining land use of livestock grazing and wildlife habitat. Should any approved seed varieties become unavailable or cost prohibitive, or more locally adapted species become available, reasonable substitutions could be made after prior consultation with and approved by the BLM and WDEQ-LQD.
- Final reclamation of mine units would be performed as soon as practicable after ground water restoration has been completed and approved by the regulatory agencies. Wells would be plugged and all surface structures and power lines removed.
- Compacted areas would be scarified, ripped, and/or disked as necessary to relieve the compaction and prepare the sub grade for topsoil placement. Where needed, the surface would be graded and contoured to approximate original contours to blend with the surrounding topography. In areas stripped of topsoil, the salvaged topsoil would be re-applied. If necessary, the replaced topsoil would be disked to create a proper seed bed. Seed bed preparation would only be performed under appropriate soil and climatic conditions.
- The reclamation goal at the Project would be to return the land to a condition that will sustain the pre-mining land use of livestock grazing and wildlife habitat.
- The success of revegetation in meeting the land use goal would be assessed prior to application for bond release by utilizing the COMA method as described in WDEQ-LQD Rules and Regulations Chapter 3, Section 2(d)(vi)(C) and LQD Guideline No.2-Vegetation (November 1997).
- At the time of bond release on all areas, including previously disturbed and reclaimed areas, the actual methodology to be used for evaluating vegetation success would be submitted to WDEQ-LQD at least 6 months prior to field sampling. Revegetation would be considered successful when, at the end of the bonding period, the following has been demonstrated:
  - The vegetation species of the reclaimed land are self-renewing under natural conditions prevailing at the site;
  - The total vegetation cover of perennial species (excluding noxious weed species) and any species in the approved seed mix is at least equal to the total vegetation cover of perennial species (excluding noxious weed species) on the area before mining:
  - The species composition and diversity are suitable for the approved post-mining land use; and
  - The above are achieved during one growing season, no earlier than the fifth full growing season on the reclaimed lands.

- In the unlikely event that any trees must be removed, Cameco would inventory such trees prior to removal and include that information and replacement cost in the appropriate annual report and surety revision submitted to WDEQ-LQD.
- In those areas where there were few or no noxious weeds prior to being affected by the ISR operations, Cameco would control and minimize the introduction of noxious weeds into the revegetated areas for at least 5 years after the initial seeding had taken place.
- The primary method of revegetation would be the pitting and seeding method. In limited areas where pitting and seeding would potentially interrupt surface water flow, such as incised drainage channels, areas with slopes steeper than 3:1 (horizontal to vertical) and permanent topsoil stockpiles, drill or broadcast seeding would be utilized.
- All reclaimed areas would remain fenced for a period of at least 2 years, or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization.

2.4 Resource Protection Alternative

The Resource Protection Alternative (RPA) was developed to respond to public and agency input collected during the scoping process. This alternative is similar to the Proposed Action described in Section 2.3, Proposed Action, of this document, in that it would involve the development of uranium deposits in the GHPA through implementation of the ISR process to remove uranium from the ore-bearing formation. The RPA would utilize the same processes and take place over the same time period as the Proposed Action but with the following changes implemented to reduce surface disturbance, travel to and from the GHPA, and impacts to soils, vegetation, and wildlife, as well as increase the number of workers and enhance reclamation speed and quality for the Project:

- **Annual Development Planning:** Surface disturbance and potential for soil compaction and erosion associated with construction in each mine unit would be reduced, and the potential for successful reclamation would be increased through submittal of an Annual Development Plan (ADP) to the BLM that would require delineation of specific areas to be disturbed along with procedures to ensure that actual disturbance remains within planned areas (Section 2.4.1, Annual Development Planning).
- **Construction Timing Constraints:** The BLM would not allow construction of Mine Unit 3 until interim reclamation on Mine Unit 1 has been shown to make significant progress toward meeting reclamation success criteria. Likewise, construction of Mine Unit 4 would not begin until Mine Unit 2 interim reclamation is successful, and Mine Unit 5 construction would not begin until Mine Unit 3 interim reclamation has been demonstrated to be successful (Section 2.4.2, Construction Timing Constraints).
- **Closed Loop Drilling System:** Excavated drilling mud pits would be eliminated and replaced with closed loop systems for the management of drilling fluids (Section 2.4.3, Closed Loop Drilling Systems).
- **Disturbance Offset for Additional Satellite Facility:** Disturbance associated with construction and operation of a second satellite facility would be offset through a requirement for reclamation of an equal area of existing unreclaimed or poorly reclaimed disturbance within the GHPA (Section 2.4.4, Disturbance Offset for Additional Satellite Facility).
- **Reduced Number of Evaporation Ponds:** The number of evaporation ponds would be reduced during operations, and the primary method of wastewater disposal would be injection into deep disposal wells (Section 2.4.5, Reduced Number of Evaporation Ponds).
- **Additional On-site Processing:** Additional on-site processing would produce yellowcake slurry, which would require fewer truck loads of product to the Smith Ranch-Highland facility (Section 2.4.6, Additional On-site Processing).

- **Enhanced Reclamation Goals and Timing:** Reclamation improvements would be realized through the use of rigorous reclamation goals and criteria, and by timely implementation of reclamation activities after completion of construction or operational activities (Section 2.4.7, Enhanced Reclamation Goals and Timing).
- **Burial of New Power Lines:** Impacts to wildlife would be reduced by burial of all new power lines (Section 2.4.8, Burial of New Power Lines).

Under the RPA not all of the surface area within the mine units would be disturbed by construction activity as is assumed under the Proposed Action. As shown in **Table 2-3**, the construction disturbance is estimated to be approximately 50 percent of the area of each mine unit. Approximately 30 percent of a mine unit area would undergo interim reclamation after construction and the remaining 20 percent would remain disturbed during operation. The following subsections describe in detail the changes in operations under the RPA relative to the Proposed Action as described in Section 2.3, Proposed Action.

2.4.1 Annual Development Planning

In order to reduce the surface disturbance associated with mine unit development the BLM would require submittal of an ADP prior to initiating surface disturbance activities for each calendar year. This plan would show in detail all areas of proposed surface disturbance and how all areas would be accessed by mechanized equipment for well drilling, well construction, and installation of underground utilities and overhead power lines. The plan also would show the locations of roads, header houses, valve boxes, and other features that would remain in place during mine unit operation. The ADP would include the development and use of a Topsoil Management Plan (TMP), which would address the need to maintain topsoil viability in long-term (remaining longer than 1 year) topsoil stockpiles. The overall goal of the plan would be to limit surface disturbance activities to less than the entire mine unit during construction activities and to eliminate cross-country travel during mine unit operations. Based on an analysis of the typical drill site layout (**Figure 2-6** and **Figure 2-7**) and typical mine unit pattern (**Figure A-1, Appendix A**) the BLM estimates that annual planning would result in a 50 percent reduction in surface disturbance during mine unit construction and would reduce impacts from cross-country travel by approximately 30 percent during mine unit operations.

Table 2-3 Resource Protection Alternative Disturbance Summary

Mine Component	Disturbance (acres)	
	Construction/ Decommissioning (+15 percent)[a]	Operation (+15 percent)[a]
Mine Unit Disturbance, Including Monitoring Well Ring		
Mine Unit 1[b]	78 (90)	31 (36)
Monitoring well ring for Mine Unit 1[c]	11 (13)	4 (5)
Mine Unit 2[b]	183 (210)	73 (84)
Monitoring well ring for Mine Unit 2[c]	10 (12)	3 (3)
Mine Unit 3[b]	45 (52)	18 (21)
Monitoring well ring for Mine Unit 3[c]	10 (12)	3 (3)
Mine Unit 4[b]	128 (147)	51 (59)
Monitoring well ring for Mine Unit 4[c]	9 (10)	3 (3)
Mine Unit 5[b]	56 (64)	22 (25)
Monitoring well ring for Mine Unit 5[c]	8 (9)	3 (3)
Subtotal for Mine Unit Disturbance	**538 (619)**	**211 (242)**

Table 2-3 Resource Protection Alternative Disturbance Summary

Mine Component	Disturbance (acres)	
	Construction/ Decommissioning (+15 percent)[a]	Operation (+15 percent)[a]
Project Infrastructure Outside of Mine Units		
Roads/Utility Corridors [d]	209	38
Surface Facilities		
Carol Shop Facility [e]	0	0
Satellite Facility [f]	0	0
Evaporation Ponds and Diversions [g]	27	27
Disposal Wells[h]	6	3
Topsoil Stockpiles	3	3
Subtotal for Disturbance Outside of Mine Units	**245**	**71**
Grand Total	**783 (864)**	**282 (313)**

[a] Mine Unit Area may expand based on results of delineation drilling, to account for this possible expansion, disturbance estimates for mine units and their associated monitoring well rings are conservatively increased by 15 percent.

[b] Disturbance of approximately 50 percent of each mine unit is anticipated during construction and decommissioning. Operational disturbance (primary and secondary roads, header houses, paths to each wellhead, valve boxes, and well heads) is conservatively estimated to be 5 percent of the Mine Unit area. An estimated 15 percent of the Mine Unit would be disturbed by planned trails (6 feet in width) to provide access to wellheads from header houses for a total disturbance of 20 percent of a Mine Unit during operation. The remaining portion of the Mine Unit disturbed during construction (30 percent of the total Mine Unit area) would undergo interim reclamation for the duration of operations.

[c] Construction disturbance for monitoring well rings is based on a disturbance width of 18 feet. Operational disturbance for monitoring well rings is based on a disturbance width of 6 feet.

[d] Road/Utility corridor construction disturbance for new, existing, and upgraded existing roads is based on a width of 60 feet for primary roads, 40 feet for secondary roads, 50 feet for underground utilities and 30 feet for buried power lines. Road/Utility corridor operational disturbance based on a width of 30 feet for primary roads, and 15 feet for secondary roads; utility corridors would undergo interim reclamation during operations. Includes disturbance for approximately 1.4 miles (8.3 acres, based on a 50-foot wide disturbance) for a process water pipeline that would not be adjacent to a proposed road.

[e] Carol Shop facility is located on 27 acres of existing disturbance and would not involve new disturbance under the Resource Protection Alternative.

[f] The disturbance for both proposed satellite facility locations was considered although only 1 would be constructed. Disturbance for each location (approximately 5 acres) includes the building plus additional area for parking and access, and would be offset by reclamation of a corresponding area. Therefore, disturbance within the GHPA due to this activity is considered to be 0 acres.

[g] Disturbance assumes construction of 2 ponds within 1 disturbance; 1 pond for operation and a second pond to accommodate repairs.

[h] Based on disturbance of 2 acres for construction and 1 acres for operation of each of 3 proposed disposal well locations. Two deep disposal test wells were drilled in 2011; further development will require re-disturbance.

Prior to any surface disturbing activity, all areas of disturbance, including 2-track access routes for mechanized equipment, would be flagged and surveyed to establish Global Positioning System (GPS) coordinates. During construction activity all mechanized equipment would be required to remain within the flagged area including during access to well sites; cross-country travel outside of flagged areas would be prohibited.

Cameco would designate reclamation coordinators responsible for ensuring that the practices identified in the ADP are followed, including any required monitoring and reporting. A reclamation coordinator would be on-site any time surface disturbance occured, particularly during more intense construction activities such as well drilling and installation of underground utilities. The reclamation coordinator would have sufficient training in soils to provide expert input on the amount of soil to be removed when stripping topsoil and would be responsible for implementing the TMP and adjusting the plan to changing field conditions throughout the life of the Project. An objective of the TMP would be to ensure topsoil segregation to maintain topsoil viability, as proper segregation of topsoil is critical to successful reclamation. The reclamation coordinator would be responsible for documenting, by using photographs or other means approved by the BLM, that travel of mechanized equipment did not occur outside of flagged areas. Photographs also would be taken at surface water monitoring sites listed in Section 2.3.8, Existing Monitoring Plans.

The ADP would include designated access trails (assumed to be 6 feet in width) between header houses and wells within mine units to be used for accessing wells during operations. In addition, low-impact all-terrain vehicles would be used to access wells and would be restricted to these designated trails for all monitoring, maintenance, and operations-related activity. Cross-country travel outside of designated trails would be prohibited during operations.

2.4.2 Construction Timing Constraints

To ensure that interim reclamation could be successfully achieved within the GHPA, the BLM would require a demonstration that reclamation methods would meet BLM criteria for successful reclamation. Construction and reclamation of Mine Units 1 and 2 would be used to demonstrate successful reclamation. Only the infrastructure needed for Mine Units 1 and 2 would be constructed before interim reclamation success has been demonstrated.

Reclamation success would be based on a quantitative demonstration that vegetation establishment on reclaimed areas was trending toward criteria set forth in Appendix E (Reclamation Objectives and Standards) of the Lander Draft RMP (BLM 2011b). If reclamation does not appear to be approaching those criteria, adaptive management would be applied to the reclamation process, and further mine unit construction would be delayed until alternate reclamation methods had been identified and demonstrated to meet success criteria. Specifically, the BLM would not allow construction activities to start on Mine Unit 3 until successful interim reclamation of Mine Unit 1 has been achieved. Construction activities would not start on Mine Unit 4 until successful reclamation of Mine Unit 2 has been achieved, and construction activities would not start on Mine Unit 5 until successful reclamation of Mine Unit 3 has been achieved.

2.4.3 Closed Loop Drilling Systems

To reduce the amount and intensity of surface disturbance the BLM would require the use of closed loop drilling mud systems instead of excavated mud pits for the management of drilling fluids and cuttings during the drilling of all wells within the GHPA. The drill site layout would be the same as for the Proposed Action (**Figures 2-6** and **2-7**) except that the mud pit and associated topsoil and subsoil piles would be eliminated and replaced with aboveground tanks with interconnecting hoses placed on the ground surface that would contain all drilling fluids and cuttings. Use of closed loop drilling systems would eliminate the excavation of drilling mud pits and the associated topsoil and subsoil piles.

The closed loop mud rotary drilling technique is identical to standard mud rotary drilling except that the drilling fluid is circulated through a container on-site rather than circulated through a pit. Mud tanks, tubs, or portable pits are used in a multitude of different sizes and configurations depending on drilling conditions (depth and diameter of hole, geology, etc.) to separate drill cuttings from the drilling mud by screen or settling (or both). The drilling mud is then recirculated down the borehole leaving the drill cuttings behind in the mud container. Upon completion of each well drill cuttings would be disposed of at a centralized location within the mine unit or at an off-site location instead of burial within a drilling mud pit.

In addition to reducing surface disturbance associated with excavation of drill pits, the use of closed loop drilling systems could increase drilling rates thereby reducing the time required to drill a well, reduce water use during drilling, enable recycling of water and drilling mud between wells, and facilitate improved reclamation by eliminating excavation of subsoils.

2.4.4 Disturbance Offset for Additional Satellite Facility

Under the RPA the BLM would require the reclamation of existing unreclaimed or poorly reclaimed surface disturbance in the GHPA to offset surface disturbance associated with construction and operation of an additional satellite facility. As a result, there would be no net increase in surface disturbance associated with the construction of an additional satellite facility. Offsets for the satellite facility would include areas such as reclaimed roads, reduced size of header houses or the Carol Shop facility, reclamation of pre-project disturbance, or other actions selected by Cameco and approved by the BLM. If a satellite facility is constructed, it would be the same as described for the Proposed Action in Section 2.3.1.1, Satellite Facilities.

2.4.5 Reduced Number of Evaporation Ponds

Under the RPA, water would be circulated and consumed at the same rate as described for the Proposed Action (Section 2.3.1.6, Water Use) and summarized in **Table 2-2**; however, the primary means for wastewater disposal would be through deep disposal wells installed in the GHPA. For clarification, these deep wells are referred to as “disposal wells” to distinguish them from the injection wells that are part of the ISR process. Cameco currently is investigating feasibility of deep disposal wells through construction of up to 3 test wells in the GHPA. Two test wells have been completed as of January 2012, but results are not currently available. If deep disposal wells are determined to be technically feasible, disposal wells would be completed at 2 of the 3 test well locations to receive wastewater for disposal. This would enable the construction of a reduced number of evaporation ponds which would be installed as back-up to the deep disposal wells.

The BLM recognizes that disposal wells require an approved Underground Injection Control Program permit from the WDEQ-WQD. The 3 test wells would be located as described in the Proposed Action and shown in **Figure 2-4**; disposal wells would be completed at 2 of the test well locations. If Cameco is able to dispose of sufficient water without construction of any 1 of the test wells or disposal wells, the amount of disturbance avoided (approximately 2.0 acres per well) would be “credited” to Cameco and available for other disturbance, such as construction of a satellite facility, as described in Section 2.4.4, Disturbance Offset for Additional Satellite Facility.

An evaporation pond (meeting the design criteria identified under the Proposed Action) would be constructed as a secondary/backup water disposal method. Because the results of testing for the 2 deep disposal test wells started in 2011 is not complete, the BLM does not have sufficient information to determine the number of evaporation ponds or deep disposal wells necessary for the Project. For purposes of impact analysis, the BLM assumed 2 ponds would be constructed; 1 for operational purposes and a second to accommodate repairs. The evaporation pond would be equipped with fountains or other aeration equipment designed to improve evaporation and flagged or netted as necessary to reduce birds accessing the pond. The pond would be fenced as described in the Proposed Action and would contain bird ladders as needed to allow birds to escape.

2.4.6 Additional On-Site Processing

The Smith Ranch-Highland facility is authorized to receive and process yellowcake slurry source material as well as ion-exchange resin under license SUA-1511 from the U.S. NRC. Under the Proposed Action approximately 1 truck load per day of uranium bonded to ion-exchange resin would be transported to the Smith Ranch-Highland facility for further processing. In this alternative, Cameco would conduct further processing of the ion-exchange resin at the Gas Hills facility to produce yellowcake slurry, which would then be transported to the Smith Ranch-Highland facility. Because the uranium concentration in yellowcake slurry is higher than in ion-exchange resin, the advantage of this alternative would be the transportation of fewer loads of material to the Smith Ranch-Highland facility. Due to this advantage, the BLM is analyzing this additional processing step as part of the RPA to enable comparison of the environmental impacts of slurry transportation with those of resin transportation under the Proposed Action.

Under this alternative Cameco would conduct several additional processes at the Gas Hills facility, including resin transfer and elution, uranium precipitation from solution, and uranium precipitate dewatering to produce yellowcake slurry. These additional steps are outlined in **Figure 2-10** and are discussed in more detail in the following subsections.

2.4.6.1 Resin Transfer and Elution

As discussed in Section 2.3.3.1, In-situ Recovery, uranium-laden groundwater would be treated using ion-exchange technology. The water would be pumped to the satellite facility where uranium would be adsorbed to ion-exchange resin beads that preferentially remove uranium from the solution. Once the resin in a column was sufficiently bonded with uranium, the column would be isolated from the normal process flow and the resin would be transferred into another column for uranium elution (also known as stripping), a process whereby the uranium is removed from the resin.

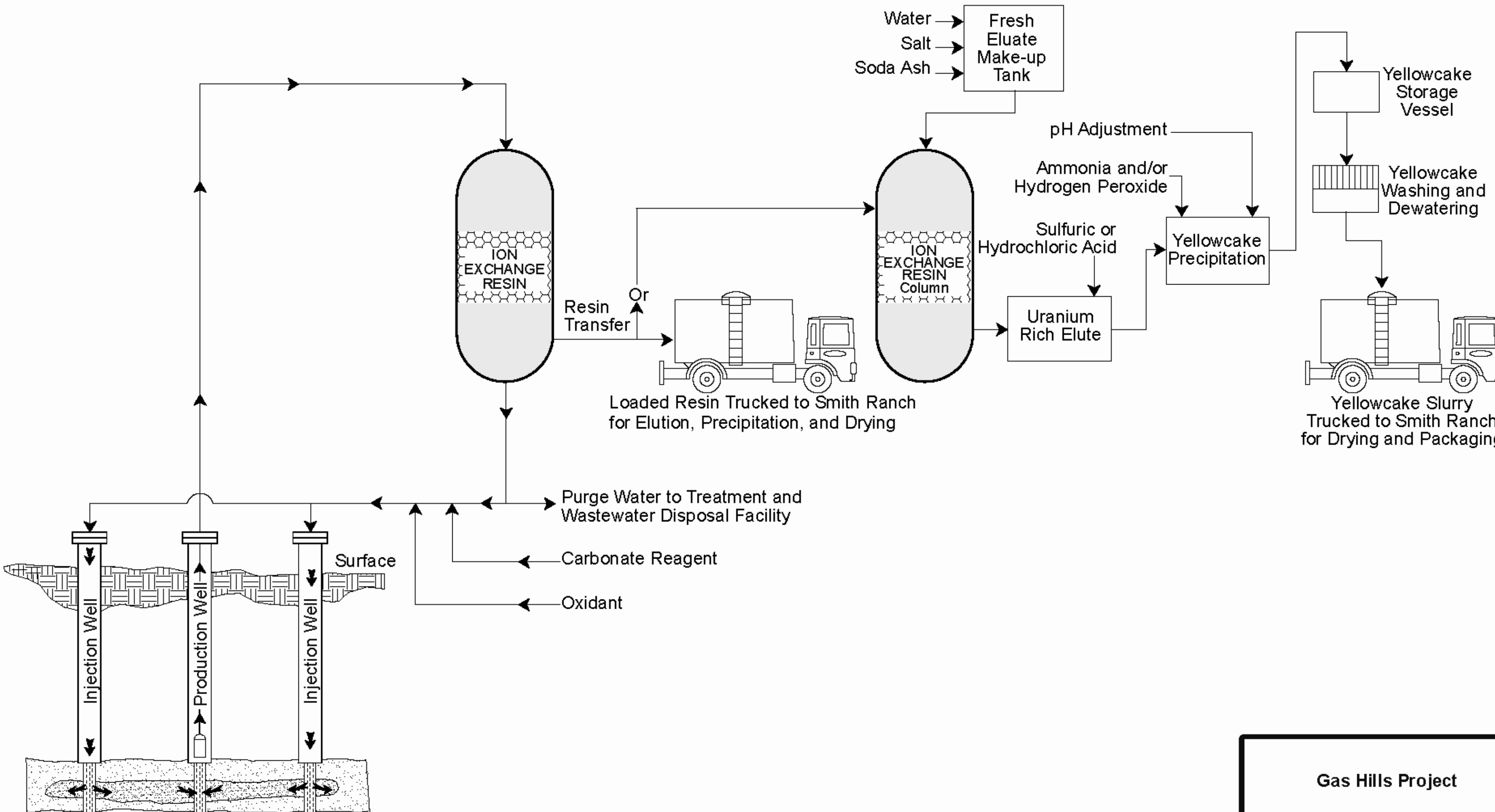
In the elution process, the resin would be contacted with a strong sodium chloride/sodium carbonate solution, which would displace (or strip) the uranium from the resin in a process very similar to regenerating a conventional home water softener. The eluted (stripped or regenerated) resin would be washed and then placed back in service for additional uranium recovery. The uranium rich fluid (rich eluate) would be pumped to the precipitation circuit for further processing.

2.4.6.2 Precipitation Circuit

The rich eluate containing the uranium would be routed to tanks for temporary storage ahead of the batch or continuous precipitation circuit. To initiate the precipitation cycle, hydrochloric or sulfuric acid would be added to the uranium-bearing solution to convert the uranyl carbonate present in the solution to uranyl chloride or uranyl sulfate, both soluble species for precipitation. Hydrogen peroxide and sodium hydroxide would then be added to the acidified eluate to effect precipitation of the uranium as uranyl peroxide or sodium diuranate. The addition of hydrogen peroxide would lower the pH of the solution, and sodium hydroxide would be added as a pH adjustment to optimize crystal growth and settling. After allowing the uranium precipitate to settle, the uranium-depleted supernate solution would be removed and stored for re-use in future elutions as lean eluate, pumped to the evaporation ponds/water treatment circuit, or disposed via deep disposal well (Section 2.3.1.2, Waste Management). Sodium chloride and sodium carbonate would be added to the lean eluate as needed for reconstitution.

2.4.6.3 Precipitate Dewatering, Filtration and Transport

The resulting slurry from the precipitation circuit would be transferred to a storage vessel, allowing the uranium to settle and consolidate by gravity. The precipitated and thickened yellowcake slurry would then be sent to a filter press for washing to remove soluble contaminates and then de-watered prior to transport to the Smith Ranch-Highland facility. The dewatered yellowcake slurry product would be placed into USDOT approved containers and transported to the Smith Ranch-Highland facility in exclusive-use, USDOT authorized transport vehicles.



Gas Hills Project

Figure 2-10

Diagram of Slurry Production

Source: PRI 2011b, Figure 1.

2.4.6.4 Additional Materials, Equipment, Energy Use, and Workforce

Additional material and chemicals that would be required to produce yellowcake slurry include additional water for eluate make-up solutions and product washing, sodium chloride and sodium carbonate for eluate make-up solutions, sulfuric and/or hydrochloric acid for pH control, and sodium hydroxide and hydrogen peroxide for precipitation. Cameco estimates the increase in water use for slurry production to be a maximum of 56 acre-feet per year from existing sources, which would correspond to an increase in consumptive water use and disposal of an additional 13 percent relative to the Proposed Action.

Additional equipment items would be located in the existing Carol Shop facility or in the second satellite facility and would include tanks for preparation and storage of eluate make-up solutions, rich eluate, precipitation, and slurry storage. A storage vessel and a filter press also would be required to complete the process. The elution/precipitation portion of the recovery plant circuit would be designed for batch or semi continuous operations. The number of batch cycles would be increased with uranium production increases. The elution circuit would operate under automated controls.

The major power requirements of an in-situ uranium facility involve the primary extraction circuit (i.e., the wellfields and associated plant circuitry). Power requirements to operate the elution and precipitation circuits are insignificant in comparison to power needed for the primary extraction circuit. Therefore, a moderate increase in power demand would be anticipated under this alternative which could be provided by the existing electrical service to the GHPA.

Cameco projects that an additional 10 workers would be required at the GHPA to carry out activities related to resin elution and yellowcake slurry generation.

2.4.6.5 Yellowcake Slurry Transport

Under this alternative yellowcake slurry would be transported to the Smith Ranch-Highland facility for further processing (drying and packaging) into yellowcake for shipping. Assuming an average production rate of 1.1 million pounds of uranium per year, the estimated number of truck loads to the Smith Ranch-Highland facility carrying yellowcake slurry would be 122 trips per year. This would be a reduction compared to the estimated 325 truck loads of resin that would be transported to Smith Ranch-Highland facility under the Proposed Action. This reduction would be partially offset by additional chemical deliveries, estimated at 1 per month per bulk chemical for hydrogen peroxide, sulfuric acid, sodium carbonate, sodium chloride, and sodium hydroxide equating to approximately 5 bulk deliveries per month. Overall, the number of transportation trips associated with yellowcake slurry production would be reduced to about ½ of those needed for the Proposed Action.

2.4.7 Enhanced Reclamation Goals and Timing

In order to promote improved reclamation with the GHPA, the BLM would require prompt reclamation of disturbed areas and the use of reclamation goals appropriate to the site's ecological potential even if the pre-disturbance vegetation included a less diverse plant community. This approach would establish a post-mining landscape closer to historic conditions present in the GHPA prior to any mining of the area rather than re-establishment of the current conditions which have been degraded by historic mining and grazing activities (BLM 1998). The following sections provide more detailed descriptions of the criteria and requirements that BLM would use to enhance reclamation within the GHPA.

2.4.7.1 Reclamation Success Criteria

In order to enhance reclamation results within the GHPA the BLM would require the evaluation of reclamation success using the reclamation criteria established in the Draft Lander RMP (BLM 2011b). The basis for these criteria is the U.S. NRCS ecological site descriptions (ESD) for each mapped ecological site found in the GHPA (USDA-U.S. NRCS 2011). An ecological site is a landform with specific physical characteristics that differ from other landforms in its ability to produce distinctive kinds and amounts of vegetation and in its response to management. For an individual ecological site the

U.S. NRCS and the BLM have developed (or are in the process of developing) ESDs to provide qualitative and quantitative data about an ecological site's biological and physical characteristics. To evaluate the functional status of an ecological site, 17 easily measurable or observable indicators have been identified that correlate with the biological and physical characteristics of an ecological site. Indicators for a site are defined in each ESD.

The following criteria are based on the ESD indicators for the ecological sites in the GHPA that would be used to evaluate interim reclamation success within a mine unit:

- 80 percent of the erosion indicator for percent ground cover (as listed on U.S. NRCS reference sheet for ESD) is met;
- At least 65 percent total plant species must be from major grasses, forbs, and/or shrubs listed in the ESD Plant Community or BLM-authorized plant species seed mix, with no noxious weeds present; and
- Must meet U.S. NRCS Reference Sheet Indicators for the ESD for erosion, compaction, and plant mortality.

Final reclamation success would be based on the following criteria:

- 90 percent of the erosion indicator for ground cover (as listed on U.S. NRCS reference sheet for ESD) is met;
- At least 80 percent total plant species must be from major grasses, forbs, and/or shrubs listed in the ESD Plant Community or BLM-authorized plant species seed mix with no noxious weeds present; and
- Must meet U.S. NRCS Reference Sheet Indicators for the ESD for erosion, compaction, and plant mortality.

Cameco would be required to submit and comply with the requirements of a noxious weed plan. The plan would identify the frequency of inspection for noxious weeds and herbicide spraying by a certified applicator. The BLM recommends, but does not require, that Fremont County Weed and Pest Department be consulted in the development of the plan. Control of noxious weeds would be met by whatever treatments necessary rather than the Proposed Action's annual spraying. Noxious weed control would be maintained around all facilities, including roads and all areas undergoing interim reclamation.

2.4.7.2 Reclamation Timing

Reclamation of construction disturbance would be started as soon as possible; as a minimum of construction was completed. Reclamation of soil disturbed to install pipelines would begin as soon as practical following construction seeding occurring during the next available seeding window.

Removal of buried infrastructure would be limited to the equipment identified by the U.S. NRC and/or the WDEQ; infrastructure that could be left in place such as buried power lines would not be removed. Reclamation of the vegetation and soils resulting from infrastructure removal would begin concurrently with removal.

Any infrastructure outside of the mine units not required for groundwater restoration or the operation of subsequent mine units would be decommissioned and reclaimed as soon as possible. Facilities would be decommissioned and reclaimed if obsolete to further plant operations.

2.4.8 Burial of New Power Lines

Approximately 21 miles of new power lines are anticipated to be constructed to supply Project components with electricity. Under this alternative, new power lines would be buried within road ROWs rather than be constructed overhead. However, burial of new power lines would have no impact on construction or operational disturbance, but would reduce potential electrocution and collision impacts to migrating and foraging migratory bird species, and would eliminate new perches for raptor and corvid species, thus reducing the potential for predation on greater sage-grouse.

2.5 Alternatives Considered but Eliminated from Further Consideration

2.5.1 Conventional Mining

Conventional mining would involve the extraction of ore by open pit or underground mining, the processing of the ore in a mill, and the disposal of mill tailings waste in a surface impoundment. The environmental impacts associated with conventional mining would be greater than the corresponding impacts of an ISR uranium recovery facility. Conventional mining methods involve excavation of soil and rock to access ore for further processing. These methods result in disturbance of the ground surface and subsurface geological materials, require the use of heavy equipment and explosives, may require dewatering during mining, and would require more overall disturbance than ISR technology. Furthermore, the target ore zones may be too deep for open pit mining methods. Given the greater disturbance footprint and potential for impacts to groundwater, surface water, vegetation, soils and wildlife, conventional mining methods will not be analyzed in detail in the EIS.

2.5.2 Seasonal Operation

This alternative would involve seasonally limiting operation of mine units to limit activity within areas with wildlife timing limitation stipulations. Control of subsurface fluids is maintained hydraulically through the injection and production process, which provides for an inward gradient within each mine unit. Because this process depends on the maintenance of constant groundwater flow gradients, the system cannot be shut down for short periods. Therefore, seasonal operation was not analyzed in detail in this EIS.

2.5.3 No Temporary Facility Closure

As stated in Section 2.3.6, Final Project Reclamation and Decommissioning, Cameco may elect under U.S. NRC regulations to place ISR operations under temporary standby for 24 months with possibility of extensions with U.S. NRC approval. The BLM was concerned that continued standby of ISR operations could result in cessation of processing activities and idling of the proposed facility without decommissioning and reclamation for an indeterminate period of time. However, under BLM's 43 CFR 3809, surface management regulations pertaining to mining-related activities (Section 3809.500), Cameco would be required to post a bond sufficient to cover the estimated costs of reclaiming the proposed operations. The bond would not be returned to Cameco until reclamation was complete, which would provide a monetary incentive for Cameco to reclaim the area, and to limit the length of a period of nonoperation. Furthermore, under Section 3809.424(a)(3), the BLM has the discretion to require removal of facilities and reclamation of the GHPA for a non-operating facility that has been inactive for 5 consecutive years. Due to these existing regulations the BLM determined it was not necessary to conduct a detailed analysis of this alternative in the EIS.

2.5.4 Additional Transportation Routes

Potential alternate transportation routes of resin or slurry from the Gas Hills site to the Smith Ranch-Highland facility were considered. Potential alternative routes considered included using Fremont County Road 5 to Jeffrey City County Road 321 south to Highway 220, roads connecting Highway 136 with Moneta or Shoshoni (Buck Camp Road or Castle Gardens Road), or County Road 201 (Poison Spider Road) to Casper. Use of these roads could reduce mileage relative to the proposed winter route through Riverton. Many of these roads are not currently designed for frequent, heavy vehicle use, and are not maintained (plowed) during winter. Because travel during winter in the region may be hindered by snow and snow drifts, plowing snow during winter months is likely to be necessary on most routes. Because the majority of the preferred winter route to Casper (136 to Riverton, and Highways 26 and 20 to Casper) has been constructed to support projected Project traffic, the majority of these roads are currently plowed by the county during winter, and because costs associated with upgrades and plowing for alternative routes, detailed analysis of the identified potential alternate routes was not included in the EIS.

2.5.5 Alternate Waste Disposal Locations

This alternative would identify a U.S. NRC-licensed site for disposal of radiologically contaminated waste materials that was closer to the GHPA than Blanding, Utah. Current estimates of potential volumes of radiologically contaminated waste to be generated by the Project would require a maximum of 20 truck loads of material per year for transport. Transportation of radiologically contaminated waste would represent a small portion of Project-related traffic, and use of a closer disposal site would not greatly reduce traffic impacts. Therefore, this alternative was not analyzed in detail in the EIS.

2.6 Comparison of Alternatives

During development of this document, the BLM determined that no lands with sufficient size, naturalness, or outstanding opportunities for either solitude or primitive and unconfined recreation to qualify as lands with wilderness characteristics were located either solely or partially within the GHPA. The area closest to the GHPA meeting those qualifications is located southeast of Dubois, Wyoming, approximately 100 miles northwest of the GHPA (BLM 2011b). Therefore, lands with wilderness characteristics are not further described, and impacts are not further discussed for any alternative within this document.

A summary of the surface disturbance associated with each of the alternatives is presented in **Table 2-4**. A comparison of impacts associated with each of the alternatives is presented in **Table 2-5**.

Table 2-4 Summary of Surface Disturbance for the Alternatives

Facility	No Action Alternative[a]	Proposed Action Alternative	Resource Protection Alternative
Mine Units	0 (acre)	977 (acres)	490 (acres)
Water Impoundments	0 (acre)	62 (acres)	27 (acres)
Disposal Wells	0 (acre)	6 (acres)	6 (acres)
Roads-Primary (2-way traffic, maintained)[b]	11 (acres) 1.8 (miles)	90 (acres) 8.0 (miles)	90 (acres) 8.0 (miles)
Roads-Secondary (1-way traffic, maintained)[c]	0 (acre)	111 (acres)	111 (acres)
Roads-2-track (not maintained) includes monitoring well rings[d]	0 (acre)	48 (acres)	48 (acres)
Buried Process Water Line	0 (acre)	8 (acres)	8 (acres)
Carol Shop Facility[e]	27 (acres)	0 (acre)	0 (acre)
Second Satellite Facility	0 (acre)	10 (acres)	0 (acre)
Long-term Topsoil Stockpiles	3 (acres) [f]	3 (acres) [f]	3 (acres)
Total Acres Disturbance[g]	**40**	**1,315**	**783**

[a] Only activities that would occur due to selection of the No Action Alternative are represented. Disturbances would occur during reclamation of a portion of the AML road and the Carol Shop facility, including redistribution of existing topsoil stockpiles.

[b] Disturbance for new and upgraded existing primary roads would be the full 60-foot wide ROW during construction and would include disturbance for power lines and pipelines adjacent to the road. Disturbance for primary roads would be 30 feet wide during operation. Except for the AML road, existing primary roads that currently are greater than the projected operational width of the Project would be reclaimed back to 30 feet wide.

[c] Disturbance for secondary roads would be the full 40-foot wide ROW during construction and would include disturbance for power lines and pipelines adjacent to the road. Disturbance for primary roads would be 15 feet wide during operation.

[d] Includes 2-track roads associated with monitoring well rings and previously existing 2-track roads outside of mine units that would remain within the GHPA.

[e] Disturbance associated with the Carol Shop facility (26.7 acres) would be reclaimed under the No Action Alternative.

[f] Approximately 2.6 acres of topsoil piles currently existing in the GHPA would be used for reclamation of the Carol Shop Road and the Carol Shop facility. Does not include long-term topsoil stockpiles within mine unit boundaries.

[g] Discrepancies in totals are due to rounding.

Table 2-5 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative
Amount of Disturbed Lands	Least impact. Reclamation of approximately **40** acres of existing disturbance.	Most impact. Approximately **1,315** acres would be disturbed.	Less disturbance than the Proposed Action. Approximately **783** acres would be disturbed.
Air Quality	Least impact. Emissions of priority pollutants would be below regulatory thresholds, and emissions of approximately **2.5** tons of greenhouse gases would occur during the reclamation of **40** acres over 1 year.	Most impact. Emissions of priority pollutants would be below regulatory thresholds, and emissions of approximately **226,000** tons of greenhouse gases would occur during the 25-year life of the Project.	Less impact than the Proposed Action. Emissions of priority pollutants would be below regulatory thresholds, and emissions of approximately **221,500** tons of greenhouse gases would occur during the 25-year life of the Project.
Cultural Resources and Native American Concerns	Least impact. Reclamation of approximately **40** acres of previously disturbed areas would not impact historic properties, and would be unlikely to impact unanticipated discoveries.	Most impact. Three historic properties would be affected, and there would be the potential for direct impacts to unanticipated discoveries from a maximum of **1,315** acres of disturbance.	Less impact than the Proposed Action. Three historic properties would be affected and there would be less potential for direct impacts to unanticipated discoveries from a maximum of **783** acres of disturbance.
Geology			
Geologic Hazards	No impact.	Most impact. Potential hazards from disturbing **7.6** acres of existing landslide deposit, undercutting slopes greater than **25** percent on **100** acres. There would be a slight risk of increases in seismic activity from deep water disposal.	Same as the Proposed Action. While less disturbance within mine units would occur, construction in areas of existing landslide deposit and slopes greater than **25** percent would require additional precautions that are likely to not reduce disturbance in these areas. There would be a slightly higher risk of increases in seismic activity from deep water disposal, as surface disposal would be reduced.
Mineral Resources	No impact.	Most impact. The BLM would not allow development of other mineral resources during the 25-year life of the Project, but would allow this development after the Project ended. The removal of **25** to **62.5** million pounds of uranium would occur.	Same as the Proposed Action.
Land Use	No impact.	No impact. Land ownership or Special Management Areas would not be impacted.	Same as the Proposed Action.

Table 2-5 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative
Livestock Grazing	Least impact. Additional forage would be available from reclamation of approximately **40** acres of existing disturbance.	Most impact. Disturbance associated with the Project would result in impacts to **1,315** acres, and fencing would restrict livestock access to **977** acres within mine units on 3 BLM grazing allotments, resulting in the loss of **61** animal unit months over the 25-year life of the Project.	Less impact than the Proposed Action. Fencing would continue to restrict livestock access to **977** acres within mine units. Livestock grazing would be impacted by evaporation ponds on **35** acres of lands less than under the Proposed Action, resulting in the loss of 1 fewer animal unit months over the 25-year life of the Project.
Noise	Least impact. Noise associated with reclamation activities would be minimal and would be short-term.	Most impact. Noise impacts would be greatest during the construction phase of the project. Impacts during operations would consist mostly of vehicle traffic noise. The absence of noise-sensitive receptors in the GHPA would result in negligible impacts.	Less impact than the Proposed Action. Noise from traffic during Project operation would be reduced due to approximately 193 fewer large truck trips per year.
Paleontological Resources			
Fossil Resources	Least impact. The potential for exposing fossil-bearing formations during reclamation of approximately **40** acres of existing disturbance is low.	Most impact. Surface disturbance with high potential to expose and impact fossil resources would occur on **1,114** acres within the GHPA.	Less impact than the Proposed Action. Surface disturbance with high potential to expose and impact fossil resources would occur on **665** acres within the GHPA. Additionally, the likelihood of exposing fossil-bearing formations would be reduced by eliminating excavation associated with drilling mud puts.
Public Health and Safety			
Radiological Exposure	No impact. Long-term monitoring of background radiation from previous mining activities would continue.	Most impact. The highest estimated dose of radiation to surrounding communities would be **7** millirem/year (7 percent of limit listed in 10 CFR Part 20). Radiation also would be monitored according to U.S. NRC rules; therefore, impacts would be low.	Same as the Proposed Action.
Hazardous Materials and Waste	Least impact. Any radiologically contaminated waste generated by reclamation of approximately **40** acres, including the Carol Shop facility, would be disposed of according to	Most Impact. On-site storage of hazardous materials would include an estimated maximum of **6,000** gallons of diesel fuel and gasoline, **100** short tons of sulfuric acid, and **10** short tons	Less than the Proposed Action. On-site storage of hazardous materials would be the same as for the Proposed Action. Accidents during the transportation of hazardous

Table 2-5 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative
	existing permits.	of sodium hydroxide. Accidents during the transportation of hazardous materials could occur an estimated 0.04 times during the Project. Accidents during the transportation of uranium-laden resin could occur an estimated 0.58 times during the Project.	materials could occur an estimated 0.05 times during the Project. Accidents during the transportation of uranium-laden yelllowcake slurry could occur an estimated 0.21 times during the Project. The accident rate for the transportation of uranium-laden yellowcake slurry would decline as the result of fewer trips between the Gas Hills Facility and the Smith Ranch-Highland facility.
Recreation	Least impact. Recreational activities could occur on approximately 40 acres of reclaimed land.	Most impact. Impacts most likely to occur would be a reduction in wildlife viewing and hunting due to animal displacement from Project-related noise. Historical uranium mining and no developed recreational facilities in the GHPA have limited current recreation, and would result in a low impact to recreation.	Less impact than the Proposed Action. The same number of roads would be constructed as for the Proposed Action, but **193** fewer heavy truck trips would occur, which would result in less noise and less reduction in wildlife viewing and hunting due to animal displacement.
Socioeconomic Conditions			
Population, Employment, and Income	Least impact. No new jobs or households would be created.	Less impact than the RPA. **148** new jobs would be created, and **58** new households would be created.	Most impact. **166** new jobs would be created and **68** new households would be created.
Environmental Justice	No disproportionate impact to poorer communities.	No disproportionate impact to poorer communities.	No disproportionate impact to poorer communities.
Soils	Least impact. The reclamation of existing disturbance, including redistribution of long-term topsoil stockpiles, would improve soil productivity on approximately 40 acres.	Most impact. Approximately **1,315** acres of topsoil and biological crusts would be disturbed. Impacts to sensitive soils within mine units (**508** acres of water erodible soils, **79** acres of compaction prone soils, **297** acres of soils with low revegetation potential, **9** acres of shallow soils, and **197** acres of stony-rocky soils) would occur. The potential for mixing topsoil and subsoil would occur from any excavation. Mixing of topsoil and subsoil, as well as compaction, also would be likely from cross-country vehicular	Less impact than the Proposed Action. Approximately **783** acres of topsoil and biological crusts would be disturbed. The reduction of disturbance within mine units would maintain topsoil viability, and reduce direct impacts to sensitive soils than the Proposed Action. Additionally, the potential to mix topsoil and subsoil would be reduced by eliminating excavation associated with drilling mud pits, and by eliminating cross-country vehicular travel. Elimination of cross-country vehicular travel also

Table 2-5 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative
		travel.	would reduce soil compaction.
Transportation	Least impact. No new roads would be constructed. Additional traffic would be as a result of the reclamation of **1.8** miles of roads within the GHPA. Travel volume would not change from current levels.	Most impact. Approximately **23** miles of new primary or secondary roads would be constructed. Traffic on roads to the GHPA would increase by a maximum average of **27** heavy and **56.7** light truck trips per day from construction and operation traffic.	Less impact than the Proposed Action. There would be no difference in miles of roads constructed, but heavy truck trips would decline to **26.5** trips per day as a result of fewer loads of uranium-laden material transported to the Smith Ranch-Highland facility and more loads of chemicals transported to the GHPA.
Vegetation	Least impact. The reclamation of existing disturbance would improve the vegetation cover and community diversity on approximately **40** acres.	Most impact. Disturbance would occur on **743** acres of shrub-dominated vegetation, which would take 3 to 5 years to reestablish. Disturbance also would occur on **15** acres n wetlands.	Less impact than the Proposed Project. Disturbance would occur on **458** acres of shrub-dominated vegetation, which would take 3 to 5 years to reestablish. Additionally, 8 acres of wetlands would be disturbed.
Noxious Weeds and Invasive Species	Least impact. The reclamation of existing disturbance would include control o noxious weeds and invasive species on approximately **40** acres.	Most impact. The disturbance of **1,315** acres would have the potential to allow establishment of noxious weeds and invasive species.	Less impact than the Proposed Project. The disturbance of **783** acres would have the potential to allow establishment of noxious weeds and invasive species.
Special Status Plant Species	No impact.	Most impact. Disturbance from the Project has the potential to directly impact individuals of the following species: Cedar rim thistle; and Rocky Mountain twinpod. The Project also has the potential to indirectly impact, through the spread of noxious weeds and invasive plant species, fugitive dust, or changes in surface water flow, the following species: Persistent sepal yellowcress; Cedar rim thistle; Beaver rim phlox; Rocky Mountain twinpod; and	Less impact than the Proposed Project. The same species as listed for the Proposed Project could be directly or indirectly impacted; however, reduced disturbance within the mine units would reduce the potential for impacts to these species.

Table 2-5 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative
		Limber pine.	
Visual Resources	Least impact. The reclamation of approximately **40** acres would temporarily cause minimal impacts to visual resources.	Most impact. Visual resources would be impacted during Project construction and would be moderately impacted during Project operation.	Same as the Proposed Action.
Water Resources			
Surface Water	Least impact. Reclamation of approximately **40** acres of previous disturbance within the GHPA would restore surface contours to approximate original drainage patterns.	Most impact. Disturbance would occur on **1,315** acres, including **15** acres of wetlands. Roads and other construction within waterways could alter existing channel geometry and cause additional headcutting, bank failure, and sedimentation. The potential of a spill of uranium-laden resin into a river during transportation would be 0.008 spills in 25 years.	Less impact than the Proposed Project. Disturbance would occur on **783** acres, including **8** acres in wetlands. The potential for impacts to waterways would be reduced. Annual development planning would encourage avoidance of, and would reduce the potential for road development in, waterways. The potential of a spill of yellowcake slurry into a river during transportation would be 0.002 spills in 25 years.
Groundwater	Least impact. No groundwater impacts would occur beyond those from past mining activity.	Most impact. Groundwater quality and quantity would be impacted by the ISR process during mine operation. Impacts would be restricted to the area within mine units and corresponding monitoring well rings (2,122 acres). Groundwater quantity would be restored to pre-mining levels prior to mine closure. Groundwater quality would be restored to pre-mining conditions, or to class of use based on WDEQ guidelines.	Same as the Proposed Action.
Water Use	No impact.	Most impact. Consumptive use of groundwater for ISR mining would occur; however, this use would not impact holders of existing water rights within the GHPA.	Same as the Proposed Action.
Wild Horses	No impact within the GHPA.	No impact within the GHPA.	No impact within the GHPA.

Table 2-5 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative
Wildlife and Fisheries (incremental acres of habitat disturbed)			
Big Game, Small Game, Raptors, Migratory Birds, Reptiles, and Amphibians	Least impact. Reclamation of approximately **40** acres of previous disturbance within the GHPA would have minimal impact.	Most impact. Approximately **1,206** acres of habitat would be disturbed.	Less impact than the Proposed Project. Approximately **733** acres of habitat would be disturbed.
Special Status Wildlife Species (incremental acres of habitat disturbed)			
White-tailed Prairie Dog	No impact.	Most impact. Approximately **5.6** acres of habitat disturbance.	Less impact than the Project. Approximately **3.0** acres of habitat disturbance.
Pygmy Rabbit	No impact.	Most impact. Approximately **93** acres of habitat disturbance.	Less impact than the Project. Approximately **65** acres of habitat disturbance.
Sensitive Bat Species	No impact.	Most impact. Approximately **1,206** acres of habitat disturbance.	Less impact than the Project. Approximately **733** acres of habitat disturbance.
Ferruginous Hawk	No impact.	Most impact. Approximately **1,206** acres of habitat disturbance.	Less impact than the Project. Approximately **733** acres of habitat disturbance.
Burrowing Owl	No impact.	Most impact. Approximately **834** acres of habitat disturbance	Less impact than the Project. Approximately **510** acres of habitat disturbance.
Greater Sage-grouse	No impact.	Most impact. Approximately **422** acres of habitat disturbance.	Less impact than the Project. Approximately **260** acres of habitat disturbance.
Brewer's Sparrow, Loggerhead Shrike, Sage Sparrow, Sage Thrasher	No impact.	Most impact. Approximately **1,206** acres of habitat disturbance.	Less impact than the Project. Approximately **733** acres of habitat disturbance.
Mountain Plover	No impact.	Most impact. Approximately **1.3** acres of habitat disturbance.	Less impact than the Project. Approximately **0.8** acre of habitat disturbance.
Northern Leopard Frog, Great Basin Spadefoot	No impact.	Most impact. Approximately **15** acres of habitat disturbance.	Less impact than the Project. Approximately **8** acres less habitat disturbance compared to the Proposed Action.
Sensitive Species	No impact.	Most impact. The Project has a low potential to	Same as Proposed Action.

Table 2-5 Comparison of Impacts

Resource/Species	No Action	Proposed Action	Resource Protection Alternative
		impact the following species: White tailed prairie dog; Pygmy rabbit; BLM sensitive bat species; Ferruginous hawk; Burrowing owl; Greater sage-grouse; Brewer's sparrow; Loggerhead shrike; Sage sparrow; Sage thrasher; Mountain plover; Northern leopard frog; and Great Basin spadefoot.	